



Research Paper

Sport as a vehicle of change for livelihoods, social participation and marital health for the youth: Findings from a prospective cohort in Bihar, India

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ABSTRACT

Background: Adolescent participation in pro-social activities such as sport can promote identity formation, self-efficacy and social support, but its benefits in India remain unassessed. We examined longitudinal effects of adolescent sport participation on economic, social and political engagement, marital health and family planning among young adults in India.

Methods: We analyzed prospective data from unmarried adolescents ($n = 2,322$, ages 15–19) who participated in the *Youth in India 2007–8* study (wave 1) and were followed in the *UDAYA* study 2015–16 (wave 2), in Bihar, India. Sport participation was assessed in wave 1. Outcomes assessed in wave 2 were economic engagement (vocational training, past year paid employment), social group participation, political participation, marriage (any and prior to 18), and among those married, marital violence [MV] and contraceptive use. We used logistic and multinomial models to assess longitudinal associations between sport and our outcomes, adjusting for age, residence and wealth at baseline and secondary schooling completion at follow-up.

Results: In multivariate models for males, adolescent sport participation was associated with higher odds of vocational training [AOR: 1.92, 95% CI: 1.17, 3.15], social program engagement [AOR: 1.89, 95% CI: 1.14, 3.15], and a trend effect for political participation [AOR: 1.47, 95% CI: 0.97, 2.24]. Among females, sport in adolescence was associated with lower child marriage [ARRR = 0.67, 95% CI: 0.48, 0.96], and higher vocational training [AOR = 1.28, 95% CI: 1.03, 1.16] and family planning use [AOR = 1.31, 95% CI: 1.05, 1.63]. Crude effects were noted for delayed marriage, paid work and perpetration of marital violence among males.

Interpretation: Evidence from India shows that sport can be an instrument supporting pro-social engagement for boys and girls. Further understanding of the gendered nature of sport and the mechanisms linking sport to agency among youth is needed.

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1. Introduction

India has more than 250 million adolescents, the largest population of adolescents of any nation in the world [1]. Adolescence is an important developmental period of transition from childhood to adulthood, and empowering adolescents through social programs can be an important means of fostering opportunities for growth and positive engagement and preventing delinquency and harmful health behaviors [2]. Promotion of socially and physically healthy adolescents is a priority because the health of this population supports future economic and political stability in a nation, and this is especially true for India, as adolescents represent 20% of the total

population of the country. Efforts to support adolescents at scale via adolescent friendly development activities in low- and middle-income countries (LMICs) such as India growing, but research to guide these approaches are limited [3]. This study seeks to examine the potential utility of sport for youth development, given its ability to be operated at scale and to support gender-transformative approaches benefiting girls and boys.

Sport and other forms of active and voluntary social participation can be a means for adolescent development. Previous research shows that male and female youth engagement in sport can reduce the likelihood of aggressive and violent behaviors [4] and promote adolescent physical and mental health through improved fitness levels [5–8] and via positive and collaborative peer engagement [7]. These effects may be driven by sport supporting positive youth development through the pathways of building self-esteem, collaboration,

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Research in context

Evidence before this study

Youth populations are rapidly rising globally, including in low- and middle income countries (LMICs), and opportunities for meaningful social engagement are urgently needed. Risks and vulnerabilities faced at home and in school, poverty, unequal access to opportunities and inequitable gender norms can leave adolescent boys and girls isolated and alone, encouraging harmful health behaviors and impacting health and wellbeing. Sport has been long-valued for physical fitness and as popular recreation and sportspersons are role models for the youth within local or national discourses. Sport can build self-confidence and peer engagement, promote health and can be a source of economic opportunity (as a career choice or through prosocial qualities such as leadership and agency). However, the potential for sport in youth engagement programs is not well understood. Rigorous research is needed to understand these benefits and pathways to better engagement, opportunity, health and gender equity. Using data from a prospective follow up of adolescents in Bihar, India, we examined how sport participation in adolescence can influence engagement in livelihood and social programs, delay marriage (especially for girls) and reduce violence in marriage among young adults, and whether benefits differed by gender.

Added value of this study

Current research shows that sport participation positively affects personality and self-concept, cardiovascular and mental health in HIC contexts. While a growing number of programs in LMICs are adopting sport for youth engagement, their short and long-term benefits remain untested. This is, to our knowledge, the first panel study to explore the effects of sport for youth engagement in India. The study found positive effects of sport participation on youth engagement outcomes, even as benefits differed across boys and girls. Among young men, we found that sport engagement was positively associated with livelihood and social program participation, and some effects on political participation and perpetration of violence on wives. Among young women, sport was associated with higher contraception use, vocational program participation and delayed marriage. Effects for girls may be explained by longer schooling and wealth effects.

Implications of all the available evidence

Despite WHO's recommendations on physical activity for the health and wellbeing of children and adolescents, few causal or observational studies have examined life-course effects of sport on youth development. Our research advances the field beyond the present view of sport for physical fitness, metabolic activity and recreation, and provides evidence for sport as a space and opportunity for the youth to be socialized, learn through collaboration and break stereotypes on gender and social inequities. We found, in this study, that the effects of sport are gendered. We believe that more attention is needed to *unpack* the underlying gender-related determinants influencing uptake of sport and recreation, and understanding the pathways that may include agency, resiliency and gender equitable norms among the youth. Sport-based youth interventions need to examine gender differences in participation and dropouts that can feed into local and national youth development programs (e.g. the Rashtriya Kishor Swasthya Karyakram (RKSK) in India).

can 'enhance self-acceptance, self-confidence, social and political understanding, and an ability to play an assertive role in controlling one's resources in the community' [10]. Opportunities to 'bond' with peers via sport may also provide feedback and protection from negative behaviours [10].

Current literature from India demonstrates, via cross-sectional analysis, the value of youth sport for fitness and long term cardiovascular health [11] as well as for promoting gender equity ideologies and behaviors for boys [12] (e.g., boys' respectful behavior with girls) and girls [13] (e.g., girls' vocalizing their preferences and choices). While these findings are promising, longitudinal analysis of sport engagement on social and health outcomes would be valuable, particularly if they include consideration of gendered nature of participation and effects given prior findings. Sport for youth engagement has also received attention in policies for the youth in India. For instance, the National Youth Policy (2014) [14] guides government investments to improve sport infrastructure, including the building and maintenance of sport facilities and coaching in both rural and urban areas through programs such as the Khelo India Scheme [15] and the National Playing Fields Association of India [16]. India's Right to Education Act (2010) [17] also committed resources for school-based playgrounds and recreational facilities to support youth sport engagement. India's national adolescent strategy, Rashtriya Kishor Swasthya Karyakram (RKSK) emphasizes peer-based learning and youth leadership as approaches that can build adolescent resiliency and improve health. While research suggests the value of these approaches in promoting youth development, the paucity of evidence on the impact of sport participation remains a concern [8].

This study offers, to our knowledge, the only longitudinal analyses on adolescent sport engagement and subsequent social and health outcomes in young adulthood in India. Our objective in this study was to examine the effects over time of sport engagement in adolescence on youth socioeconomic and health outcomes. For the purposes of this study, we borrow from Piskur et al's definition of social participation [18], which includes consumer participation (used as economic participation, in our analyses), involvement in society (measured as political participation), and social activity (measured as social group participation). In terms of health outcomes, we focus on aspects of marital health that are priority areas under RKSK's national adolescent health strategy in India [19,20]. Research on this topic is limited, especially in LMICs where sport can be a popular avenue for youth engagement, but few studies exist that examine long-term effects and pathways to change. We stratified our analyses by sex, recognizing that sport engagement itself may be gendered, given societal norms and restrictions often placed against girls' engagement in sport, recreation or their mobility [21,22] as well as the gender differences seen in our outcomes of interest, with males more likely than females to be socially engaged and females more likely than males to report an absence of marital safety [23].

2. Methods

2.1. Study design and data

We conducted longitudinal analysis of data from a prospective cohort of adolescent boys and girls aged 15–19 years in Bihar, India, who participated in the *Youth in India Study* (2007–08) and were retained for follow-up in the *Understanding the lives of Adolescents and Young Adults* (Udaya) 2015–16 study, when they were aged 23–28 years old. Data for these studies were collected by the Population Council supported by India's Ministry of Health and Family Welfare (MOHFW), development partners and an external advisory group that served as a monitoring board given the vulnerability of the sample.

and kinship [9]. Sport for youth engagement represents a strengths-based approach and promotes qualities similar to volunteering that

2.2. Sample

The Youth in India study, conducted in 2007–08, involved recruitment of a state-representative sample of adolescents and young adults aged 15–24 years, inclusive of an unmarried sample of 15–19 year olds ($n = 1081$ boys and 2773 girls). A representative subsample of 15–19 year olds was selected and followed up for a second survey in 2015–16, as part of the Udaya study; this follow-up subsample included boys and girls unmarried at baseline ($n = 628$ boys and 1970 girls). We limited our analyses to the subsample of 15–19 year olds unmarried in 2007–08 (wave 1) and followed in 2015–16 (wave 2) and for whom we had all available data ($n = 563$ boys and 1759 girls, or 89–90% of the wave 2 subsample). Of this final analytic sample, 278 males and 1522 females were married by wave 2 and were able to be included in the analyses on marital violence and contraceptive use as well.

2.3. Data collection

Given the sensitivity of the topic and the nature of participants, several efforts ensured ethical implementation of the study. These included meetings with community leaders, training of data collection staff, sex-matching staff to respondents, obtaining informed consent from both the youth and their parents, following confidentiality and privacy protocols and providing information booklets on health and related services to participants. Subsequent to collection of data, surveys were taken to the study management site for data entry and management. Paper surveys were used in 2007–08 and electronic data collection techniques were adopted in 2015–16. Using a software package, data were entered twice by different data entry operators to minimize errors. Protocols were established for monitoring data quality; responses to open-ended questions were scrutinized and common codes were provided to the responses. Entered data were monitored to ensure accurate data entry given reliance on paper surveys in 2007–08, but for both waves, data was monitored for quality and consistency, and efforts were made to address any issues identified at review. Low mobility of the study population and connection to community leaders during baseline study efforts facilitated follow-up of participants. Sensitive study procedures, as outlined above, were used for follow-up data collection. See study report for more details on data collection [24,25].

2.4. Measures

Study instruments for baseline and follow-up surveys were developed using measures from existing international and national survey efforts focused on youth, including the National Family Health Survey [23], India's largest demographic and health survey. (See report for more details on measures [26].)

Our independent variable of interest, *sport engagement (current)*, was assessed in the baseline survey in 2007 by: “Do you play any sports or games these days?” Responses were coded as No (reference), versus Yes. Further, to understand the intensity of sport engagement, adolescents were asked: “How often do you play?”, and responses included ‘Rarely’, ‘Sometimes’ and ‘Often’. We created a categorical variable on the intensity of sport engagement with the responses, ‘No’, ‘Yes – Rarely’, ‘Yes – Sometimes’ and ‘Yes – Often’. Additionally, to understand gender interactions through sport, adolescents were asked: “How often do or did you do the following activities together with your friends who are/were (girls/boys)”, with responses as ‘Never’, ‘Sometimes’ and ‘Often’. The reports of girls playing sport with other girls or boys playing sport with other boys were referred to as “Same-sex sport” and reports of adolescents playing sport with the opposite sex were referred to as “Mixed Sport”. We created measures of Same Sex Sport and Mixed Sport categorized as ‘Never’, ‘Sometimes’, ‘Often’ and ‘Did Not Report’.

Dependent variables from the follow-up data included measures of *economic engagement* (receipt of vocational training conducted by government, private or non-governmental institution and past year paid work for which respondent received cash or kind), *political participation* (involvement in any political activities such as election rallies and protests) and *social group membership* in the last five years (including self-help groups (SHGs) or any other groups). SHGs are groups for women, so for males, we used only the second item to assess social group participation. We categorized all outcomes as No versus Yes.

Our marital health dependent variables included delayed marriage, contraceptive use in marriage, and no spousal violence in marriage, based on follow-up survey responses. To assess *delayed (first) marriage*, participants were asked about the month and year of their first marriage, or their age at first marriage with responses categorized as unmarried (reference group), married after 18 years of age, and married at age 15–17 years. We used 18 years as the cut-off for early marriage among both boys and girls per global standards in child marriage [27] even though in India, the legal age for marriage among boys is 21 years. The latter was used in models on degree of sport engagement as low numbers in sub-groups led to unstable estimates. To assess *contraceptive use* among the married subsample, participants were asked if they had ever used a method to prevent or delay pregnancy categorized as “No” versus Yes. To assess *spousal violence* perpetrated by males against wives, married female participants were asked if they had ever experienced various forms of violence from their husbands including slapping, punching, choking and other. Married male participants were asked if they had ever perpetrated these types of violence on their spouses. Responses to these questions, reported as ‘Yes’ or ‘No’ were aggregated to create a measure of any spousal violence, which was recoded as “No” (reference) versus Yes. The study did not collect data on perpetration of violence by women on men.

To address bias, particularly related to socioeconomic determinants and gendered context of sport participation, we adjusted for key covariates in the analyses; as the study sample size was small, caution was maintained to avoid over-adjusting. Socioeconomic status of adolescents, be it their own education or wealth of households were likely to influence the uptake of sport. Hence, our covariates of interest included age, urban or rural residence, and wealth at baseline (wave 1) and completion of secondary school (at wave 2). Wealth quintiles, based on household asset and amenities data (e.g. type of house, agricultural land, access to toilets, cooking fuel, drinking water, and electricity) were included in the analyses, with the poorest quintile considered as reference, other categories included poorer, middle, richer and richest quintiles. We considered but eventually did not include age at marriage as a covariate in the analyses for contraception use and intimate partner violence (IPV) due to collinearity with age which was adjusted for as a covariate. Sensitivity analyses including the variables age and age at marriage were conducted (not reported) and did not impact the effect estimates for sport participation or other covariates.

2.5. Analyses

We used chi-square tests to assess differences in socioeconomic characteristics at baseline by sport participation among unmarried boys and girls, and differences in outcomes at follow-up by sport participation at baseline for males and females. Differences in contraceptive use and IPV were assessed for the married sub-sample only. Multivariate association between playing sport in adolescence (as a dichotomous as well as categorical measure) and the log odds of economic, political and social engagement at follow-up were examined for unmarried boys and girls using logistic regression models, adjusted for covariates. Similarly, multivariate association between playing sports in adolescence (as a dichotomous as well as categorical

measure) and delayed marriage was examined using multinomial regression models, adjusted for all covariates. For the subsample of males and females married by wave 2, we examined the association of playing sports in adolescence on contraceptive use and spousal violence at follow-up. We conducted descriptive analyses examining sport participation with same sex and opposite sex adolescents. We also conducted sensitivity analyses to examine possibility of selection bias in the follow-up comparing sport participation and key characteristics in the panel sample with estimates from the cross-sectional Youth in India study report (2007–8). All analyses were conducted using STATA 15.

3. Results

Among girls in this study ($n = 1759$), the majority resided in rural areas (66.2%) and had not completed their secondary education (Table 1). Twenty-eight percent (28.1%) had received no formal education, and an additional 42.6% had not completed secondary school. One in three girls (35.9%) reported that they had participated in some sport or games in wave 1, with richer and more educated girls

significantly more likely to report sport participation. Most girls were married by wave 2 (86.5%), with 34.5% married prior to age 18 years. Among those who were married by wave 2, almost half (41.4%) had experienced physical violence from their husband, and had never used any form of contraception (43.9%). Most had not participated in social programs (87.1%) or been engaged in some employment for cash or in kind over the past 12 months (72.8%). Almost one in three (30.6%) had participated in some vocational training. Greater representation of wealthier relative to poorer participants was noted at baseline, suggesting potential for greater loss to follow-up of poorest girls at wave 2 (Supplementary Table 1).

Among boys in the study ($n = 563$), 52.4% resided in rural areas, and nearly half (49.3%) had not completed secondary education (Table 1). More than one in ten (11.7%) had received no formal education. 2.5% of boys married before 18 years, while one in two boys was unmarried. As with the girls in the study, greater representation of wealthier relative to poorer males was seen for this subsample (Supplementary Table 1), indicating potentially greater loss to follow-up for poorer participants. The majority of boys (63.9%) reported that they had participated in sport or games at wave 1, significantly

Table 1
Sociodemographic description of the baseline Youth in India study sample (time 1) by sport participation (current) and study outcomes in the follow-up Udaya study (time 2) for the cohort of unmarried boys and girls.

Variables	Total ^b N = 1759	Unmarried girls at time 1			P-value (Test of Association)	Total ^b N = 563	Unmarried boys at time 1		
		Played sport (current/these days) ^c		P-value (Test of Association)			Played sport (current/ these days) ^c		P-value (test of association)
		No (n = 1126) n (%)	Yes (n = 633) n (%)				No (n = 203) n (%)	Yes (n = 360) n (%)	
<i>Participant demographics</i>									
Mean Age (SE) in years	16.04 (0.03)	16.12 (0.036)	15.90 (0.047)	0.002	16.65 (0.055)	17 (0.09)	16.46 (0.06)	<0.0001	
<i>Education</i>									
No education	494 (28.08)	364 (73.68)	130 (26.32)	<0.0001	66 (11.72)	48 (72.73)	18 (27.27)	<0.0001	
<=8 years of school	750 (42.64)	449 (59.87)	301 (40.13)		212 (37.66)	71 (33.49)	141 (66.51)		
>8 years of school	515 (29.28)	313 (60.78)	202 (39.22)		285 (50.62)	84 (29.47)	201 (70.53)		
<i>Rural/Urban</i>									
Urban	594 (33.77)	375 (63.13)	219 (36.87)	0.5	268 (47.60)	102 (38.06)	166 (61.94)	0.3	
Rural	1165 (66.23)	751 (64.46)	414 (35.54)		295 (52.40)	101 (34.24)	194 (65.76)		
<i>Wealth Index</i>									
Poorest	190 (10.80)	130 (68.42)	60 (31.58)	0.02	30 (5.33)	13 (43.33)	17 (56.67)	0.3	
Poorer	231 (13.13)	163 (70.56)	68 (29.44)		50 (8.88)	22 (44.00)	28 (56.00)		
Middle	301 (17.11)	206 (68.44)	95 (31.56)		96 (17.05)	37 (38.54)	59 (61.46)		
Richer	402 (22.85)	255 (63.43)	147 (36.57)		136 (24.16)	52 (38.24)	84 (61.76)		
Richest	635 (36.10)	372 (58.58)	263 (41.42)		251 (44.58)	79 (31.47)	172 (68.53)		
<i>Social participation and marital health reported at time 2</i>									
<i>Social Program Participation</i>									
No	1533 (87.15)	974 (86.50)	559 (88.31)	0.2	455 (80.82)	179 (88.18)	276 (76.67)	0.001	
Yes	226 (12.85)	152 (13.50)	74 (11.69)		108 (19.18)	24 (11.82)	84 (23.33)		
<i>Political Participation</i>									
No	1665 (94.66)	1063 (94.40)	602 (95.10)	0.5	366 (67.65)	143 (72.59)	223 (64.83)	0.06	
Yes	94 (5.34)	63 (5.60)	31 (4.90)		175 (32.35)	54 (24.41)	121 (35.17)		
<i>Vocational Training</i>									
No	1221 (69.41)	811 (72.02)	410 (64.77)	0.002	437 (77.62)	176 (86.70)	261 (72.50)	<0.0001	
Yes	538 (30.59)	315 (27.98)	223 (35.23)		126 (22.38)	27 (13.30)	99 (27.50)		
<i>Employment, Past 12 Months</i>									
Never	1281 (72.83)	808 (71.76)	473 (74.72)	0.07	95 (16.87)	23 (11.33)	72 (20.0)	0.01	
Not in the last year	201 (11.43)	124 (11.01)	77 (12.16)		45 (7.99)	13 (6.40)	32 (8.89)		
Yes	277 (15.75)	194 (17.23)	83 (13.11)		423 (75.13)	167 (82.27)	256 (71.11)		
<i>Delayed Marriage</i>									
Unmarried	237 (13.47)	130 (11.55)	107 (16.90)	0.004	285 (50.62)	89 (43.84)	196 (54.44)	0.01	
Married at 18 or older	915 (52.02)	589 (52.31)	326 (51.50)		263 (46.71)	105 (51.72)	159 (43.89)		
Married <18	607 (34.51)	407 (36.15)	200 (31.60)		15 (2.66)	9 (4.43)	6 (1.67)		
<i>Male-Perpetrated Marital Violence^a</i>									
No IPV	873 (58.55)	555 (57.22)	318 (61.04)	0.1	191 (69.71)	72 (63.16)	119 (74.38)	0.04	
IPV	618 (41.45)	415 (42.78)	203 (38.96)		83 (30.29)	42 (36.84)	41 (25.62)		
<i>Contraceptive Use^a</i>									
No	851 (56.06)	580 (58.41)	271 (51.62)	0.01	155 (56.16)	68 (59.65)	87 (53.70)	0.3	
Yes	667 (43.94)	413 (41.59)	254 (48.38)		121 (43.84)	46 (40.35)	75 (46.30)		

^a Analyses for contraceptive use and marital violence was conducted among married populations, females at Time 2 ($N = 1522$) and males at Time 2 ($N = 278$).

^b Column percentages for the participant demographics and outcomes.

^c Row percentages for participant demographics by sport engagement and column percentages of outcomes by sport engagement.

higher compared to girls, with educated boys significantly more likely to report sport participation. Among those who had married, one-fourth (25.6%) admitted to perpetrating physical violence against their wife. Half of participants (56.2%) reported never using contraceptives in marriage. The minority of boys (35.2%) reported political participation.

Sport participation among unmarried adolescent girls was associated with higher reports of vocational training (35.2% vs. 27.9%, $p = 0.002$), lower past year employment (13.11% vs. 17.23%, $p = 0.07$), lower likelihood of marriage before 18 years (31.6% vs. 36.1%, $p = 0.004$) and higher contraception use in marriage (48.38% vs. 41.59%, $p = 0.001$) (Table 1). Similarly, sport participation among adolescent boys was associated with higher political participation (35.2% vs. 24.41%, $p = 0.06$), higher vocational training (27.5% vs. 13.3%, $p < 0.0001$), higher likelihood of being unmarried (54.4% vs 43.8%, $p = 0.01$), and lower likelihood of perpetrating spousal violence (25.6% vs 36.8%, $p = 0.04$).

In multivariate analyses for males, sport in adolescence was associated with higher likelihood of participation in social programs [AOR: 1.89, 95% CI: 1.14, 3.15] and vocational training [AOR: 1.92, 95% CI: 1.17, 3.15], with a trend effect seen for political participation as well [AOR: 1.47, 95% CI: 0.97, 2.24] (Table 2). Completion of secondary education among boys was a key influencer of vocational training [AOR = 3.95 (95% CI: 1.26, 12.34)]. Among females, sport participation influenced higher likelihood of vocational training [AOR: 1.28 (95% CI: 1.03, 1.6)], adjusted for all covariates (Table 2). Secondary education was associated with higher likelihood of vocational training [completed secondary education, AOR = 3.91 (95% CI: 2.71, 5.66)] and lower likelihood of paid work in the last year [AOR = 0.56 (95% CI: 0.41, 0.78)]. Rural girls reported lower vocational training [AOR = 0.49 (95% CI: 0.38, 0.62)] and a wealth effect was noted on paid work in the last year [AOR for the richest quintile = 0.34 (95% CI: 0.21, 0.54)]. No rural-urban differences in social participation and vocational training outcomes were noted for boys. Corresponding findings for both boys and girls were noted by the degree of sport participation (Table 3).

Sport participation in adolescence among boys was not associated with marital health outcomes after adjusting for covariates (Table 4). Completion of secondary education was associated with lower likelihood of early marriage [ARRR = 0.13 (95% CI: 0.03, 0.58)] and lower perpetration of violence on wives [AOR = 0.45 (95% CI: 0.22, 0.93)]. Sport participation among girls showed a protective effect on child marriage or marriage prior to age 18 years [ARRR = 0.67 (95% CI: 0.48, 0.96)] and an increase in the use of contraception [AOR = 1.31 (95% CI: 1.05, 1.63)] in multivariate regression models (Table 3). Higher schooling was associated with lower likelihood of earlier marriage [compared to girls who were unmarried, ARRR for marriage before 18 years = 0.10 (95% CI: 0.05, 0.19); ARRR for marriage after 18 years = 0.34 (95% CI: 0.19, 0.61)]. Rural girls were more likely to be married early [ARRR for married before 18 years = 3.75 (95% CI: 2.56, 5.5) and ARRR for married after 18 years of age = 2.71 (95% CI: 1.94, 3.79)] and were less likely to use contraception [ARRR = 0.71 (95% CI: 0.55, 0.91)] in marriage. Corresponding models with sport as a categorical exposure validated the findings (Table 5).

4. Discussion

Analyses of data from a prospective follow-up of adolescents from Bihar, India showed positive but different effects of playing sport in adolescence for girls and boys, with effects on livelihoods and social participation for boys and girls, and effects on delayed marriage and contraceptive use for girls.

Among boys, crude models showed that playing sport in adolescence was associated with higher vocational training and political participation, delayed marriage and lower perpetration of violence on wives; adjusted for secondary school, wealth and age, findings were

Table 2 Multivariate regression analyses (Odds Ratios and 95% Confidence Intervals) assessing the associations between sport engagement in youth in 2007 (time 1) and social/political/economic engagement in young adulthood in 2015 (time 2) among the Youth in India and Udaya cohort of unmarried boys and girls (2007–15).

Regressors	Unmarried girls (N = 1759)				Unmarried boys (N = 563)			
	Social programs	Political participation	Vocational training	Paid work last year	Social programs	Political participation	Vocational training	Paid work last year
Sport engagement at time 1 (Ref: No)								
Schooling upto 8 years (Ref: No education)	0.86 (0.64, 1.17)	0.84 (0.54, 1.32)	1.28* (1.03, 1.6)	0.78 (0.59, 1.03)	1.89* (1.14, 3.15)	1.47 (0.97, 2.24)	1.92* (1.17, 3.15)	0.69 (0.44, 1.09)
Schooling more than 8 years (Ref: No education)	0.99 (0.71, 1.41)	1.38 (0.80, 2.38)	2.25* (1.63, 3.08)	0.56 (0.41, 0.78)	1.15 (0.43, 3.06)	0.69 (0.75, 1.68)	1.92 (0.63, 5.87)	0.54 (0.19, 1.49)
(Ref: No education)	0.95 (0.61, 1.48)	1.47 (0.78, 2.78)	3.91* (2.71, 5.66)	1.05 (0.71, 1.56)	2.71 (0.98, 7.49)	0.91 (0.48, 1.73)	3.95* (1.26, 12.34)	0.39 (0.14, 1.08)
Rural (Ref: Urban)	1.37 (0.94, 1.99)	0.75 (0.47, 1.18)	0.49* (0.38, 0.62)	0.56 (0.42, 0.74)	0.81 (0.48, 1.35)	1.12 (0.75, 1.68)	0.95 (0.59, 1.51)	0.82 (0.51, 1.32)
Age (continuous)	0.86* (0.76, 0.97)	0.95 (0.78, 1.16)	1.02 (0.93, 1.12)	0.92 (0.81, 1.03)	0.81* (0.67, 0.97)	0.9 (0.78, 1.04)	0.82* (0.69, 0.96)	1.2* (1.01, 1.42)
Wealth Quintile: Poorer (Ref: Poorest)	0.66 (0.39, 1.09)	0.64 (0.27, 1.52)	1.17 (0.7, 1.94)	0.69 (0.43, 1.10)	0.91 (0.54, 6.75)	1.38 (0.51, 3.71)	1.76 (0.34, 9.09)	0.36 (0.039, 3.33)
Wealth Quintile: Middle (Ref: Poorest)	0.69 (0.42, 1.13)	0.86 (0.39, 1.86)	1.36 (0.84, 2.20)	0.51* (0.32, 0.82)	0.91 (0.26, 3.23)	1.23 (0.49, 3.06)	2.07 (0.44, 9.81)	0.22 (0.027, 1.77)
Wealth Quintile: Richer (Ref: Poorest)	0.79 (0.49, 1.27)	0.71 (0.34, 1.51)	1.26 (0.79, 2.01)	0.42* (0.26, 0.66)	0.83 (0.24, 2.79)	1.05 (0.43, 2.57)	2.62 (0.57, 11.97)	0.20 (0.026, 1.63)
Wealth Quintile: Richest (Ref: Poorest)	0.41* (0.24, 0.70)	0.60 (0.28, 1.29)	1.36 (0.85, 2.18)	0.34* (0.21, 0.54)	0.92 (0.25, 3.35)	0.74 (0.29, 1.83)	3.19 (0.67, 15.15)	0.06* (0.008, 0.52)
N	1759	1759	1759	1759	563	563	563	563
Wald Chi2	41.77	5.04	165.75	57.09	31.50	13.12	42.59	53.04
Prob. > Chi2	<0.0001	0.83	<0.0001	<0.0001	0.0002	0.15	<0.0001	<0.0001
Pseudo R2	0.0310	0.0064	0.0886	0.0359	0.0606	0.0206	0.0783	0.1068

Note: * $p \leq 0.05$; Figures in parentheses are 95% CIs.

Table 3
Multivariate regression analyses assessing the associations between **degree of sport engagement** in youth in 2007 (time 1) and social/political/economic engagement in young adulthood in 2015 (time 2) among the Youth in India and Udaya cohort of unmarried boys and girls (2007–15).

Regressors	Unmarried Girls (N = 1759)				Unmarried Boys (N = 563)			
	Social Programs	Political Participation	Vocational Training	Paid Work last year	Social Programs	Political Participation	Vocational Training	Paid Work last year
Sport engagement degree: Rarely (Ref: No)	0.60 (0.21,1.75)	0.68 (0.16,2.91)	1.05 (0.56,1.97)	0.59 (0.23,1.51)	1.72 (0.63,4.65)	1.52 (0.69,3.30)	1.37 (0.53,3.52)	0.76 (0.32,1.80)
Sport engagement degree: Sometimes (Ref: No)	0.92 (0.67,1.28)	0.89 (0.56,1.44)	1.33* (1.04,1.69)	0.85 (0.63,1.16)	1.78* (1.04,3.06)	1.56 (0.99,2.45)	1.72* (1.01,2.92)	0.70 (0.42,1.16)
Sport engagement degree: Often (Ref: No)	0.70 (0.35,1.39)	0.68 (0.24,1.93)	1.19 (0.76,1.87)	0.53 (0.26,1.07)	2.18* (1.15,4.14)	1.27 (0.72,2.24)	2.64* (1.44,4.83)	0.66 (0.36,1.18)
Schooling upto 8 years (Ref: No education)	0.99 (0.71,1.41)	1.38 (0.80,2.38)	2.24* (1.63,3.08)	0.56* (0.41,0.78)	1.16 (0.44,3.11)	0.68 (0.36,1.29)	1.99 (0.66,5.98)	0.54 (0.19,1.49)
Schooling more than 8 years (Ref: No education)	0.94 (0.61,1.47)	1.47 (0.78,2.76)	3.91 (2.70,5.65)	1.04 (0.70,1.54)	2.72 (0.98,7.5)	0.91 (0.48,1.72)	3.98* (1.29,12.23)	0.39 (0.14,1.08)
Rural (Ref: Urban)	1.36 (0.93,1.98)	0.75 (0.47,1.18)	0.49* (0.38,0.62)	0.55* (0.42,0.74)	0.80 (0.48,1.34)	1.12 (0.75,1.68)	0.95 (0.59,1.52)	0.82 (0.51,1.32)
Age (continuous)	0.86* (0.76,0.98)	0.95 (0.78,1.16)	1.02 (0.93,1.12)	0.92 (0.81,1.03)	0.81* (0.67,0.97)	0.89 (0.77,1.04)	0.82* (0.69,0.97)	1.19* (1.01,1.42)
Wealth Quintile: Poorer (Ref. Poorest)	0.66 (0.39,1.09)	0.64 (0.27,1.52)	1.17 (0.71,1.94)	0.69 (0.43,1.10)	1.89 (0.53,6.69)	1.37 (0.51,3.67)	1.73 (0.34,8.98)	0.36 (0.039,3.36)
Wealth Quintile: Middle (Ref. Poorest)	0.69 (0.42,1.13)	0.86 (0.39,1.87)	1.36 (0.84,2.20)	0.52* (0.32,0.83)	0.92 (0.26,3.22)	1.23 (0.49,3.04)	2.10 (0.45,9.86)	0.21 (0.02,1.77)
Wealth Quintile: Richer (Ref. Poorest)	0.79 (0.49,1.26)	0.71 (0.34,1.50)	1.25 (0.79,1.99)	0.41* (0.26,0.65)	0.83 (0.25,2.82)	1.04 (0.43,2.52)	2.70 (0.59,12.22)	0.20 (0.025,1.64)
Wealth Quintile: Richest (Ref. Poorest)	0.41* (0.24,0.70)	0.60 (0.28,1.29)	1.35 (0.84,2.18)	0.34* (0.21,0.54)	0.91 (0.25,3.31)	0.74 (0.30,1.82)	3.16 (0.67,15.77)	0.06* (0.008,0.52)
N	1759	1759	1759	1759	563	541	563	563
Wald Chi2	41.76	5.34	166.68	59.53	31.89	13.54	47.25	52.99
Prob. > Chi2	<0.0001	0.9136	<0.0001	<0.0001	0.0008	0.25	<0.0001	<0.0001
Pseudo R2	0.0318	0.0069	0.0889	0.0374	0.0616	0.0215	0.0837	0.1070

Note:

* $p \leq 0.05$; Figures in parentheses are 95% CIs.

Table 4

Multivariable analyses assessing the associations between sport engagement in youth in 2007 (time 1) and delayed marriage, contraceptive use and experience of intimate partner violence (IPV) in young adulthood in 2015 (time 2) among the Youth in India and Udaya cohort of unmarried boys and girls (2007–15).

	Unmarried Girls (N = 1759)				Unmarried Boys (N = 563)			
	Married after 18 years (Ref: Not Married)	Married before 18 years (Ref: Not Married)	Experience of IPV by husband (Ref: No)	Family Planning Use (Ref: No)	Married after 18 years (Ref: Not Married)	Married before 18 years (Ref: Not Married)	Perpetration of IPV on wives (Ref: No)	Family Planning Use (Ref: No)
Sport engagement at time 1 (Ref No)	0.78 (0.58,1.06)	0.67* (0.48,0.96)	0.92 (0.74,1.16)	1.31* (1.05,1.63)	1.04 (0.68,1.57)	0.27 (0.11,1.24)	0.74 (0.41,1.36)	1.36 (0.80,2.31)
Schooling upto 8 years (Ref: No education)	0.52* (0.29,0.91)	0.26* (0.15,0.47)	0.82 (0.64,1.06)	1.37* (1.06,1.77)	0.45* (0.21,0.95)	0.13* (0.03,0.58)	0.45* (0.22,0.93)	0.67 (0.33,1.36)
Schooling more than 8 years (Ref: No education)	0.34* (0.19,0.61)	0.10* (0.05,0.19)	0.41* (0.29,0.58)	1.66* (1.19,2.33)	0.24* (0.11,0.51)	0.06* (0.01,0.31)	0.21* (0.09,0.48)	1.51 (0.73,3.15)
Rural (Ref: Urban)	2.71* (1.94,3.79)	3.75* (2.56,5.50)	1.24 (0.95,1.61)	0.71* (0.55,0.91)	2.87* (1.87,4.38)	9.36 (1.80,48.6)	1.22 (0.64,2.32)	0.67 (0.37,1.22)
Age (continuous)	1.36* (1.19,1.55)	0.73* (0.62,0.87)	1.05 (0.95,1.15)	1.21* (1.10,1.33)	1.69* (1.44,1.98)	0.86 (0.51,1.45)	0.86 (0.69,1.05)	1.12 (0.91,1.37)
Wealth Quintile: Poorer (Ref. Poorest)	1.09 (0.38,3.10)	1.08 (0.38,3.05)	1.14 (0.76,1.71)	1.26 (0.84,1.90)	0.58 (0.17,1.93)	0.88 (0.09,7.87)	0.67 (0.21,2.11)	1.89 (0.66,5.49)
Wealth Quintile: Middle (Ref. Poorest)	0.62 (0.26,1.51)	0.42 (0.17,1.04)	0.65* (0.44,0.95)	1.18 (0.79,1.75)	0.51 (0.17,1.57)	0.80 (0.09,6.54)	1.28 (0.46,3.52)	1.01 (0.38,2.66)
Wealth Quintile: Richer (Ref. Poorest)	0.79 (0.33,1.89)	0.59 (0.25,1.43)	0.91 (0.62,1.32)	0.83 (0.56,1.22)	0.36 (0.12,1.07)	0.29 (0.03,2.47)	1.87 (0.70,5.0)	1.81 (0.70,4.69)
Wealth Quintile: Richest (Ref. Poorest)	0.48 (0.20,1.11)	0.27* (0.11,0.65)	0.71 (0.47,1.07)	1.36 (0.91,2.05)	0.27* (0.09,0.82)	0.47 (0.05,4.51)	0.79 (0.27,2.35)	1.31 (0.48,3.52)
N	1759	1759	1491	1518	563	563	274	276
Wald Chi2	517.23	517.23	72.80	87.72	156.46	156.46	28.31	19.84
Prob. > Chi2	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0008	0.01
Pseudo R2	0.1505	0.1505	0.0377	0.0453	0.1744	0.1744	0.0957	0.0542

Note:

* $p \leq 0.05$; Figures in parentheses are 95% CIs; analyses for family planning and intimate partner violence were conducted on married sub-samples.

Table 5
Multivariate regression analyses assessing the associations between **degree of sport engagement** in youth in 2007 (time 1) and d delayed marriage, contraceptive use and experience of intimate partner violence (IPV) in young adulthood in 2015 (time 2) among the Youth in India and Udaya cohort of unmarried boys and girls (2007–15).

	Unmarried Girls (N = 1759)				Unmarried Boys (N = 563)			
	Married after 18 years (Ref: Not Married)	Married before 18 years (Ref: Not Married)	Experience of IPV by husband (Ref: No)	Family Planning Use (Ref: No)	Married after 21 years (Ref: Not Married)	Married before 21 years (Ref: Not Married)	Perpetration of IPV on wives (Ref: No)	Family Planning Use (Ref: No)
Sport engagement degree: Rarely (Ref: No)	1.25 (0.49,3.19)	1.07 (0.35,2.97)	0.75 (0.41,1.39)	2.79 (1.42,5.48)	0.82 (0.32,2.11)	0.95 (0.32,2.78)	0.39 (0.09,1.72)	1.61 (0.48,5.40)
Sport engagement degree: Sometimes (Ref: No)	0.73 (0.52,1.01)	0.67* (0.46,0.97)	0.97 (0.76,1.25)	1.15 (0.91,1.47)	0.99 (0.60,1.65)	1.17 (0.65,2.13)	0.93 (0.48,1.80)	1.30 (0.74,2.29)
Sport engagement degree: Often (Ref: No)	0.91 (0.49,1.68)	0.61 (0.30,1.24)	0.78 (0.48,1.27)	1.60 (1.00,2.54)	0.95 (0.51,1.77)	0.70 (0.31,1.57)	0.50 (0.19,1.26)	1.44 (0.63,3.31)
Schooling upto 8 years (Ref: No education)	0.52 (0.29,0.91)	0.26* (0.15,0.47)	0.82 (0.64,1.06)	1.38* (1.06,1.78)	0.55 (0.24,1.24)	0.27* (0.12,0.62)	0.44* (0.21,0.91)	0.67 (0.33,1.36)
Schooling more than 8 years (Ref: No education)	0.34* (0.19,0.62)	0.10* (0.05,0.19)	0.41 (0.29,0.58)	1.67 (1.19,2.34)	0.38* (0.17,0.86)	0.09 (0.04,0.23)	0.20 (0.09,0.47)	1.53 (0.74,3.16)
Rural (Ref: Urban)	2.73* (1.95,3.81)	3.77* (2.57,5.53)	1.23 (0.95,1.61)	0.71* (0.56,0.92)	2.63* (1.64,4.21)	3.72* (2.09,6.60)	1.22 (0.64,2.33)	0.67 (0.37,1.22)
Age (continuous)	1.36* (1.19,1.55)	0.73* (0.62,0.86)	1.05 (0.95,1.15)	1.21 (1.10,2.34)	1.81* (1.52,2.16)	1.38* (1.13,1.70)	0.85 (0.69,1.06)	1.12 (0.91,1.37)
Wealth Quintile: Poorer (Ref: Poorest)	1.08 (0.38,3.08)	1.07 (0.38,3.04)	1.14 (0.76,1.71)	1.27 (0.84,1.92)	0.45 (0.12,1.62)	0.92 (0.23,3.61)	0.69 (0.22,2.18)	1.90 (0.66,5.49)
Wealth Quintile: Middle (Ref: Poorest)	0.63 (0.26,1.52)	0.43 (0.17,1.05)	0.65* (0.44,0.96)	1.18 (0.79,1.76)	0.36 (0.11,1.17)	0.95 (0.27,3.39)	1.36 (0.49,3.75)	1.01 (0.39,2.62)
Wealth Quintile: Richer (Ref: Poorest)	0.80 (0.34,1.92)	0.60 (0.25,1.46)	0.90 (0.62,1.31)	0.85 (0.57,1.25)	0.31* (0.09,0.97)	0.43 (0.12,1.51)	1.80 (0.67,4.85)	1.84 (0.71,4.74)
Wealth Quintile: Richest (Ref: Poorest)	0.48 (0.21,1.12)	0.27* (0.11,0.65)	0.71 (0.47,1.07)	1.38 (0.92,2.08)	0.21* (0.07,0.69)	0.42 (0.11,1.51)	0.78 (0.26,2.33)	1.32 (0.49,3.53)
N	1759	1759	1491	1518	563	563	274	276
Wald Chi2	519.94	519.94	74.08	94.07	171.00	171.00	31.79	19.98
Prob. > Chi2	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0008	0.0457
Pseudo R2	0.1512	0.1512	0.0382	0.0490	0.1485	0.1485	0.1040	0.0547

Note:
* $p \leq 0.05$; Figures in parentheses are 95% CIs; analyses for family planning and intimate partner violence were conducted on married sub-samples; among boys, age at marriage was classified as before and after 21 years as regression analyses could not be conducted with before or after 18 years categorization due to a number of null responses. Categorization of 21 years is considered legally relevant in India.

retained only for vocational training and social program participation. Findings for boys resonate with research on youth programs in LMICs that use sport to build confidence, supportive relationships, bonding, self-esteem, positive outlook, encourage thinking about a future and taking action within their communities that may act as pathways to outcomes. [10,28] Sport as a form of youth engagement to build prosocial norms can be particularly effective for boys and reduce their risk of delinquency during adolescence. Sport based grassroots programs have also enabled greater self-belief, decision-making and help-seeking among boys and reduced immediate pleasure-seeking [28]. Our study found some evidence of sport reducing IPV in marriage, though this effect was explained by schooling and other covariates. It is still an important finding for the global movement to reduce violence against women and points to a need for building early interventions that can socialize boys on gender equity in interpersonal relationships. In this study, we noted findings for boys on livelihoods and pro-social behavior, which could be attributed to an emphasis on attributes of responsibility and team-play via sport. At the same time, we also noted that interactions through sport with the opposite sex were limited or largely unreported (Supplementary Table 2), which may explain the null findings on the other outcomes. Qualitative research to understand interactions between boys and girls in sport-based youth engagement, particularly in contexts with limited intermixing may contribute to better understanding of the mechanism around changing gender norms. The gendered nature of participation (nature, type, duration, traditional league-based or non-team) in sport-based youth programs and how sport furthers or modifies prevalent gender norms also needs more research.

Among girls in Bihar, we found some evidence of the association of sport with higher vocational training, lower paid work, lower prevalence of child marriage and higher contraceptive use. In adjusted models, findings for vocational training, delayed marriage and contraceptive use were retained. Sport-based programs have been increasingly used in LMICs to empower girls and change community norms [28,29] with qualitative findings showing that these programs shape confidence, challenge perceptions, create support networks and modify sexual relations of girls with boys [29]. This is among the first studies that shows a longitudinal association, particularly on delaying child marriage and on vocational training, which are important for shaping girls' long-term development. Sport programs have also encouraged girls to identify mentors/coaches to ask for help, articulate strengths and goals, and to make back-up plans [28]. However, the mechanisms linking sport to girls' agency need further exploration as such research could inform the modification and design of existing and new youth programs. Girls' recreation can often be limited by the demands placed on them regarding domestic work, mobility restrictions, safety concerns and prevailing social norms about sport as an activity for boys. Our findings indicated an important role of secondary schooling, which may be one of the few avenues for girls' recreation. Rural-urban differences in opportunities for girls' recreation also need further study. It is also possible that the sport and games that girls play do not necessarily challenge gender stereotypes and girls may be engaging in curriculum based routine participation sports in schools, which may explain some null findings. Participation of girls in sport and how gender norms are shaped within sporting opportunities need further investigation.

A complex set of factors including parental consent and resources, community infrastructure and schooling may be driving sport participation [30,31]. These factors may set the gendered contexts within which adolescents live and participate in sports; it is likely that girls and boys participated in different types of sport, which this study did not collect data on, or that sport participation worked differently, as noted in effects on different outcomes. Secondary school was an important covariate in our study and out of school adolescents, particularly girls, may have limited opportunities for peer engagement

and recreation. Sport-based youth programs within schools and communities can strengthen the adolescent health program (RKSK) in India [32]. Interventions also need to focus on changing norms among parents and elders in the community, who act as ‘gatekeepers’ and make decisions on recreation participation, marriage and livelihood choices of adolescents [30,33–35].

This cohort study among adolescents in India is among a few within LMIC contexts that offers a longitudinal lens to study the benefits of sport on adolescent development. More studies are needed that utilize causal and longitudinal designs in LMICs while also giving attention to measurement of agency, self-efficacy and norms as pathways to study the benefits of sport-based youth programs at individual and community levels. Sport offers an innovative and age-appropriate way of engaging the youth; a clearer understanding of mechanisms linking sport to youth development can improve program design and better interpretation of the meaning of the findings from these programs.

Findings of this study need to be considered in light of the following considerations. *Firstly*, we did not have more data on the nature of sport engagement (e.g. team versus non-team, or types of games), which could have been valuable in improving our understanding the findings, beyond noting an effect by participation and degree. Qualitative studies that investigate the type and duration of recreation, parental support, school versus community based programs and the environment supporting sport can allow us more reflection on how or why adolescents participate in sport [30]. *Secondly*, our findings are based on self-reports which may be prone to reporting/recall bias. The prospective nature of this study minimizes these concerns around reporting. *Thirdly*, socioeconomic differences in the characteristics of the sample followed and lost was a concern as this population is likely to be mobile due to livelihood or marriage reasons. Data collectors had reported that rigorous data tracking and maintaining relationships with the community led to minimal losses to follow up. We did not have data on the lost population but were able to compare key socioeconomic characteristics among the Bihar sample from the Youth in India study with the baseline data from the cohort sample followed (Supplementary Table 1). This sensitivity analyses showed that the cohort sample was wealthier compared to the original participants, which may explain some of the findings. *Finally*, inferences on causality from this study need to be interpreted with caution as this study was a prospective observational study and did not assess the effect of sport as an intervention.

5. Conclusion

This study from India showed evidence that sport can increase social participation and benefits for livelihoods among adolescents, and delay marriage and increasing contraceptive use among girls. Sport-based youth engagement programs can influence self-efficacy and prosocial values through bonding with peers and altering inequitable gender norms. We found in this study that the benefits of sport were different for boys and girls and more research is needed to understand the gendered nature of sport participation and the ways in which youth development programs like the RKSK in India can create opportunities through sport to build agency and resiliency among young people.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.eclinm.2020.100302.

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