Associations between Active and Inactive Behaviours and Depressed affect among Adolescents in Navi Mumbai, India

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Mental health is a significant global health concern. Elevated levels of depressive affect predict negative mental health states including diagnosed depression. Many behaviours are associated with depressive affect and two potentially modifiable behaviours are active behaviours reflecting time spent in activities such as organised sport, recreational activities and exercise programs and inactive behaviours reflecting leisure time spent sitting idle, watching television or playing electronic/video games. This study examined associations between active and inactive behaviours and depressive affect among adolescents living in Navi Mumbai. A sample of 1,095 adolescents (46% male) aged 12-25 years (M=16.1 years, SD=2.1), from nine schools and colleges completed the Adolescent Health and Wellbeing Questionnaire (AHWQ). Measures of total weekly time spent in active and inactive behaviours were computed from relevant items. Depressive affect (Depressive Mood Scale) scores ranged from 0-30 (M=7.2, SD=2.4) and just under one third (31.2%) of respondents had scores indicating at least 'some' recent experience of depressive affect. Most (64%) respondents engaged in <5 hours of activity each week and 15% reported ≥14 hours engaged in inactive behaviours each week. Multiple linear regression analysis revealed that meeting the WHO physical activity guidelines was associated with lower levels (b=-0.35, 95% CI: -0.66, -0.03) and increases in inactive time was associated with higher levels (b=0.06, 95% CI: 0.03, 0.09) of depressive affect after controlling for age, gender, standard of living, religious affiliation, caste, general health, as well as alcohol and drug use. The findings are consistent with international studies highlighting relationships between active and inactive behaviours and depressive affect. Longitudinal studies are needed to better understand these relationships – especially in light of rapid changes in adolescent use of technology and an increasing shift to more sedentary lifestyles in India.

Keywords: Adolescents, depressive affect, physical activity, sedentary behaviour

Depression is a significant global public health issue, particularly among adolescents. Adolescents experiencing depression are at greater risk for suicide, attempted suicide, impaired function, development of co-morbid psychological disorders and substance misuse/ dependence disorders (Fombonne et al., 2001). Individuals experiencing depression through adolescence are also more likely to suffer from depression during adulthood (Mash & Wolfe, 2005). Recent international studies (e.g., USA, Australia) indicate relatively high levels of depressive affect among adolescents and that these levels are increasing. Studies with Indian adolescent samples indicate similar trends (Mohanraj & Subbaiah, 2010; Nair et al. 2004; Vashisht et al., 2014). Many factors have been identified as important determinants of adolescent depression. Individual level, factors such as age, gender, general health state as well as alcohol and drug use may contribute to increased risk for depression. Lifestyle behaviours such as time spent being physically active as well as time spent in sedentary activities such as watching television and playing computer/video games may also contribute to increased risk for depression. This study examines levels of physically active and inactive

behaviours and depressive affect among Indian adolescents.

The association between physical activity and depressive symptoms in adults is well established (Teychenne, Ball & Salmon, 2008). Although there are fewer studies among adolescents, these studies have generally shown lower depressive symptoms for those who are physically active (e.g., Kremer et al., 2014; Ussher et al., 2007). One prospective study of 11 to 14 year old adolescents in the United Kingdom, reported an increase in physical activity of approximately one hour per week was associated with an 8% decrease in the odds of depressive symptoms (Marko et al., 2008). There is also a growing view that sedentary behaviours including watching television and playing computer/video games may have an effect on mood independent of physical activity. For example, evidence indicates that frequent or high use of television predicts later lower self-esteem, depressive symptoms (Sund et al., 2011) and other negative health outcomes (Iannottiet al., 2009; Johnson et al., 2002) in adolescents.

The purpose of this study was to investigate associations between active and inactive behaviours and adolescent mental health, specifically depressive affect. Data from a large observational study carried out in Navi Mumbai, India that focused on adolescent health and well-being was used to assess adolescent behaviours and depressive affect. The aims were to report on: (1) levels of active behaviours, inactive behaviours and depressive affect among Indian adolescents; and (2) associations between active and inactive behaviours and depressive affect after controlling for covariates including age, gender, caste, language, general health and prior alcohol and drug use.

Method

Sample and sample selection

The study was carried out in coeducational schools, junior colleges and senior colleges of various nodes of Navi Mumbai. A list of all schools and colleges (n=78) within the Navi Mumbai area was generated and then stratified according to socioeconomic category. Three schools/colleges representing each socioeconomic stratum were randomly selected and classrooms at each school/college were then selected. Thus, the sample consisted of students from selected classrooms in nine schools and colleges.

Instrument

The Adolescent Health and Wellbeing Questionnaire (AHWQ) (Solomon, 2007) was a 23 section instrument that was an adaptation of the Adolescent Health Development Questionnaire (AHDQ) (Jessor et al., 2003). The AHWQ also included five subscales from the General Wellbeing Schedule (GWBS) (Dupuy, 1977) as well as 11 personal demographic items.

Measures

Depressive affect was indicated by the Depressive Mood Scale of the AHDQ. This scale consists of three items where respondents report on their feelings over the past six months. Items include 'Just felt worried about things?', 'Felt hopeless about the future?' and 'Just felt depressed about life in general?' Responses are indicated using a four point response scale: 'A lot' (4), 'Some' (3), 'A little' (2), and '1 Not at all' (1). The Depressive Mood Scale has been reported to have good internal consistency (Jessor et al. 2003).General health was assessed via a single item: 'In general, how is your health?' with response options being 'Excellent' (5), 'Very good' (4), 'Good' (3), 'Fair' (2), and 'Poor' (1). Weekly time in active behaviours was indicated by two items from the 'Daily Activities' scale of the AHDQ. These items asked about time spent after school and on weekends 'Taking part in an organized sport or recreation program (like cricket or martial arts)?'and 'Working as part of a personal exercise program (like jogging or gymnastics)?'.Similarly, weekly time in sedentary behaviours was indicated by three items from the 'Daily Activities' scale. These items included 'Watching TV or videos?', 'Playing computer or video games?', and 'Just sitting around doing nothing?'. Response options were 'None', 'One hour/week', '2-3 hours/week', '4-5 hours/week', '6-7 hours/week', and '8 or more hours/week'. Alcohol and drug use were indicated by separate items from the 'Alcohol' and 'Drugs' scales of the AHDQ. The alcohol item asked 'Have you had a drink of beer, wines or liquor more than two or three times in your life – not

just a sip or a taste of someone else's drink? and response options included 'No' (0) and 'Yes' (1). The drugs item asked 'Have you ever tried any drugs like Ganja, Charas, brown sugar or other illegal drugs?' and response options were 'No, never' (0), Yes, once' (1), 'Yes, more than once' (2). The personal demographic items included questions for gender, age, linguistic background, religion, and caste. The revised Standard of Living Index (SLI-R) was used as an indicator of standard of living. The SLI-R consists of items relating to living arrangements (e.g., type of housing facility; number of rooms; housing structure) and ownership of household items (e.g., refrigerator / radio or CD player, television / cycle / telephone / scooter or bike / car or jeep) that are weighted and used to derive a total SLI-R score ranging from 0-20. Finally, the honesty of student responses was assessed using a single item ('How honest were you in filling out this survey?') with response options including 'Very honest' (5), 'Mostly honest' (4), 'Somewhat honest'(3), 'Honest once in a while' (2) and 'Not at all honest' (1).

Procedure

Letters describing the study were distributed to the school/college administrators and consent was obtained from all students. Paper-based questionnaires were completed by students at school/college class setting in large group administration sessions proctored by research staff. Confidentiality of information, anonymity of participants, and honesty of responses were emphasized in the set of standardized instructions.

Data treatment and analysis

Checks of the honesty variable indicated there were 34 dishonest (operationally defined as being less than 'Somewhat honest') respondents (3% of initial sample of 1,129). Data for these respondents were excluded for present study purposes, yielding a final analysis n of 1,095 cases.All variables were checked for missing and out of range values. The Depressive Mood Scale score was computed by summing scores on the three items and scale reliability (internal consistency) was assessed using Cronbach's alpha. Responses for the Caste (Upper caste vs all non-upper castes), Religion (Hindu vs all other

religions), and Linguistic background (Marathi vs all other linguistic backgrounds) variables were recoded to binary form. Total SLI scores were categorised as 0-6 'Low standard of living', 7-12 'Medium standard of living', and ≥ 13 'High standard of living'.Descriptive statistics (means, standard deviations, proportions) were used to summarise the socio demographic, active and inactive, and depressive affect variables. Sample proportions meeting activity and screen time recommendations were computed and Chi-square tests used to assess differences for gender. Separate t-tests and one-way Analysis of Variance (ANOVA) were used to test for differences on depressive affect for subgroups of predictor variables. Relationships between depressive affect and the (continuous) total weekly activity time and total weekly inactive time were assessed using Pearson's correlation statistic. Multiple Linear Regression was used to assess relationships between the active (binary) and inactive (continuous) behavioural variables and depressive affect controlling for socio demographic (age, gender, caste, religion, linguistic background and standard of living), lifestyle (lifetime alcohol use, lifetime drug use) and health (self-reported general health) variables. All analyses were conducted using SPSS (V22) and statistical significance accepted as $p < .05$.

Results

Demographics

Most respondents were aged between 13 and 21 years (one respondent reported their age as 12 years and one as 25 years; M=16.1 years, SD=2.1) and just over half (54.3%) were female. Most (68.9%) reported a middle level standard of living; being from the upper castes (75.6%) and Hindu religion (78.1%), and just over one third (35.9%) were from a Marathi linguistic background. A majority of respondents reported no prior alcohol (79.7%) or drug use (95.1%) and their health status as good or better (89.4%).

Active and inactive behaviours

On average, respondents reported spending 3.9 hours (SD=3.6) in organised activities and 8.7 hours (SD=4.9) in sedentary activities each week, the latter including 6.9 hours (SD=3.8) of

weekly screen-based leisure time. Based on the aggregated organised activities measure, 32.1% of the sample met levels recommended by the World Health Organisation, and the proportion of males (43.8%) meeting this level was almost double that of females (22.2%; $\chi2$=57.3, p<.001). Similarly, using the aggregated screen-time measure, 93.7% of the sample met international recommendations (< two hours/day) for screen-time, and the proportion of males (90.2%) meeting this level was lower than that of females (96.6%; $\chi2$=18.0, p<.001).

Depressive affect

Assessment of the Depressive Mood Scale (depressive affect) indicated acceptable reliability (Cronbach'sα=.75). The overall sample mean for depressive affect was 7.2 (SD=2.4) and just under one third (31.2%) of respondents had scores indicating at least 'some' recent experience of depressive affect. Results of subgroup analyses revealed differences in levels of depressive affect for linguistic background, previous alcohol use and general health button differences for age, gender, caste, religion, standard of living and previous drug use (see Table 1). There were no significant subgroup differences for either of the categorised physical activity and screen time measures although in each instance a non-significant trend was observed (see Table 1). Assessment of the relationship between depressive affect and the continuous versions of the total weekly active time and total weekly inactive time indicated significant effects; specifically depressive affect decreased as total weekly active time increased (r=-.07, p=.03) and increased as total weekly inactive time increased (r=.11, p<.001).

Table 1: Summary of depressive affect scores for sample subgroups

Variable	M	SD	t/F	p
Age				
Younger	7.2	2.3	0.3	.77
Older	7.2	2.5		
Gender				
Male	7.1	2.4	-1.2	.24
Female	7.3	2.3		
Caste				
Upper castes	7.2	2.4	0.9	.37
Other	7.3	2.3		
Religion				
Hindu	7.2	2.4	0.5	.61
Other	7.3	2.3		
Linguistic background				
Marathi	7.0	2.3	-2.0	.04
Other	7.3	2.4		
SLI-R category†				
Lower	7.2	2.3	0.4	.69
Middle	7.2	2.3		
Upper	7.4	2.5		
Previous alcohol use				
No	7.1	2.3	-3.8	<.001
Yes	7.8	2.6		
Previous drug use				
No	7.2	2.4	0.3	.76
Yes	7.1	2.4		
General health				
Poor/Fair	8.3	2.5	5.1	<.001
Good/Very good/Excellent	7.1	2.3		
Physical activity				
Meets recommendation	7.0	2.4	1.9	.08
Doesn't meet recommendation	7.3	2.4		
Screen time				
Meets recommendation	7.2	2.4	1.8	.07
Doesn't meet recommendation	7.7	2.3		

SLI: Standard of Living Index – Revised; General health: 1=poor, 2=fair, 3=good, 4=very good, 5=excellent; Physical activity recommendation based on WHO recommendations (World Health Organization, 2011); Screen time recommendations based on Australian guidelines for adolescents (Department of Health, 2014)

Results of the multiple regression analysis indicated that higher levels of depressive affect were associated with previous alcohol use and greater amounts of inactive time and lower levels were associated with better general health and greater active time (i.e., meeting international recommendations for physically active behaviour). No significant associations were discerned for age, gender, caste, religion, linguistic background; standard of living and previous drug use (see Table 2).

Table 2: Adjusted associations between weekly active and sedentary behaviours and depressive affect

Variable	b	95% CI	t	p
Age	-.03	-0.10, 0.04	-0.75	.46
Gender, Female	.24	-0.06, 0.53	1.57	.12
Caste, Other (non-upper) castes	-.28	-0.63, 0.06	-1.61	.11
Religion, Other (non-Hindu) religions	.01	-0.33, 0.35	0.06	.96
Linguistic background, Other (non-Marathi)	.27	-0.04, 0.58	1.70	.09
SLI-R category	.06	-0.20, 0.32	0.44	.66
Previous alcohol use, Yes	.72	0.36, 1.08	3.96	<.001
Previous drug use, Yes	-.20	-0.85, 0.44	-.62	.54
General health	-.32	-0.48, -0.15	-3.76	<.001
Physical activity, Meets recommendation	-.33	-0.65, -0.02	-2.08	.04
Weekly sedentary behaviour (hours)	.06	0.03, 0.09	3.65	<.001

Gender: 0=male, 1=female; Caste: 0=upper castes, 1=other (non-upper)castes; Religion: 0=Hindu, 1=other (non-Hindu) religions; Linguistic background: 0=Marathi, 1=other (non-Marathi) language; SLI: Standard of Living Index – Revised: 1=low, 2=middle, 3=high; Previous alcohol use: 0=no, 1=yes; Previous drug use: 0=no, 1=yes; General health: 1=poor, 2=fair, 3=good, 4=very good, 5=excellent; Physical activity: 0=doesn't meet WHO recommended level, 1=does meet WHO recommended level

Discussion

This study examined depressive affect among adolescents in a large metropolitan city in India; it specifically examined cross-sectional associations between time spent in active and sedentary behaviours and depressive affect after controlling for socio demographic and other lifestyle factors. The findings indicated that approximately two-thirds of Indian adolescents were insufficiently active but also that most did not engage in high-levels of weekly screen time (as narrowly defined by TV/video time and playing computer or video games). These proportions were also patterned by gender; specifically males were more likely to be active but also more likely to spend time in screen-based leisure pursuits. Scores on the Depressive Mood Scale indicated that approximately one third of the sample recorded a score indicative of some recent experience of depressive affect. Unilabiate results indicated that those from a non-Marathi linguistic background, who reported previous alcohol use and lower levels of general health had higher depressive affect scores. Results of the adjusted multivariate analyses indicated that previous alcohol use and higher levels of weekly sedentary time were associated with higher levels of depressive affect while better general health and higher levels of weekly activity time were associated with lower levels of depressive affect.

The present findings indicate that a significant proportion of Indian adolescents experience relatively frequent symptoms of depressive affect. Levels of depressive affect were similar for younger and older adolescents and for males and females. Previous international research has indicated independent and interactive effects for age and gender. It is unclear why levels of depressive affect were not similarly patterned in this study however contextual and methodological factors may partly account for the lack of consistency. Depressive affect was also related to linguistic background whereby by those from other (non-Marathi) linguistic

backgrounds experienced higher levels of depressive affect. Conceptually, linguistic background may be viewed as a proxy indicator of geographic transition and thus the finding may reflect emotional difficulties associated with geographic relocation. Previous studies have indicated negative affective states such as depression and anxiety after geographic transitions such as those from rural regions into large metropolitan regions where significant social and economic readjustment is required. Consistent with other international studies, levels of depressive affect were higher for those having previously consumed alcohol. International studies have also reported associations between drug use and depressive affect but no such association was observed for this study. The substantially lower levels of previous/current drug use may account for the observed non-association. Levels of depressive affect were higher for those with poorer levels of (self-reported) general health, a finding consistent with previous international evidence.

Based on the constructed physical activity measure, a majority of adolescents were insufficiently active. It is noted that the two indicators used to construct the physical activity measure do not capture all forms of activity and thus levels of physical activity are likely to be under-estimated. The patterning of physical activity for gender however was consistent with other international studies whereby males are consistently found to be more physically active than females. Since there are no established international guidelines for sedentary behaviour it is difficult to establish the significance of this risk factor however it would seem that Indian adolescents, like adolescents from other nations, do spend considerable time being sedentary. The sedentary behaviour measure was constructed from responses to three indicators (TV time + Video/electronic games + Sitting idly). It is likely that these three indicators do not fully capture the total time that adolescents spend being sedentary and so the weekly estimate of nearly nine hours is again likely to be an under-estimate. The screen time behaviour estimate was referenced against levels adopted by numerous countries (typically indicated as less than 2 hours/day for

adolescents). On the basis of the constructed screen time measure (and using the criteria of < 2 hours/day) there were a relatively small proportion of Indian adolescents who did not meet the recommendation. This proportion was again patterned by gender with males less likely to meet this recommendation. While the screen time finding is a positive one, it is noted that interpretation of the findings should be done with caution since the indicators used to construct the screen time measure did not capture other forms of screen time (e.g., smart phones, tablets …) and thus it is conceivable that the proportion not meeting recommendations (advocated by other nations) would be substantially higher.

Despite the issues associated with the physical activity and sedentary behaviour measures, the multivariate analysis indicated that both were independently associated with depressive affect. Adolescents who met the WHO recommendation for physical activity had lower levels of depressive affect and those indicating lower levels of sedentary behaviour had lower levels of depressive affect - findings consistent with international studies. In this way, the findings suggest that both increasing levels of physical activity through engaging adolescents in organized sport and other forms of exercise and activity as well as reducing the time where adolescents are sedentary may be simple and cost effective ways to both prevent and help attenuate depressive symptoms. Further studies are needed to better elucidate these relationships but for now they offer some guidance on where and how future prevention efforts might be directed.

The study had a number of limitations that are acknowledged. The study design was cross-sectional and so it is not possible to determine the cause and effect relationships between physical activity and sedentary behaviour with depressive affect. Nor is it possible to assess possible bidirectional relationships between both physical activity and sedentary behaviour with depressive affect. The sample was drawn from one region within metropolitan Mumbai, so caution is needed in generalizing the findings to the broader Indian adolescent population. The physical activity and sedentary behaviour measures were constructed from two and three

items respectively and are unlikely to fully capture both of these behaviours. Furthermore, self-report measures are prone memory recall bias whereby time in physical activity is typically over-estimated and screen/sedentary time under-estimated. The depressive affect measure was different to that used in many other similar studies which limit comparison of findings across studies. The drug and alcohol use measures were based on single items so may also be inaccurate. Finally, while efforts were made to ensure that the items were readily understood by respondents, they were developed for Western populations and so some items may lack cultural relevance or understanding. With these issues in mind, longitudinal studies that include culturally appropriate measures of depressive affect as well as other lifestyle behaviours are needed to advance understanding in this area. An expanded study population and the use of objective measures of physical activity and sedentary behaviour would also be important ways to strengthen future studies.

In conjunction with the findings of other similar studies, the present findings indicate that a substantial proportion of Indian adolescents experience elevated levels of depressed affect. Given that elevated symptoms may act as a pathway to diagnosable depression the role of both increasing physical activity and reducing sedentary behaviour may prove to be important protective factors for reducing risk at a population level. Studies that help clarify the nature of the causal pathways between both physical activity and sedentary behaviour with depressive affect among Indian adolescents are needed. Similarly, studies that monitor the rapidly changing lifestyles of Indian adolescents and the factors related to both active and sedentary behaviours in the face of sweeping economic and technological change are needed.

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