

# Regional comparisons of walking or bicycling for fun or exercise and for active transport in a nationally distributed sample of community-based youth

R. P. Saunders<sup>1</sup> , M. Dowda<sup>2</sup>, K. McIver<sup>2</sup>, R. R. Pate  and  
 on behalf of the Healthy Communities Study Team

<sup>1</sup>Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina, Columbia, SC, USA; <sup>2</sup>Department of Exercise Science, Arnold School of Public Health, University of South Carolina, Columbia, SC, USA

Address for correspondence: RP Saunders, Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina, 921 Assembly Street, Columbia, SC 29208, USA. E-mail: rsaunders@sc.edu

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## Summary

**Background:** Physical activity helps prevent excessive weight gain in youth. Few studies have examined regional variations in common activities, walking and bicycling.

**Objective:** The primary aim was to examine participation in previous 7-day walking/bicycling for active transport and for fun/exercise by region, gender and age groups.

**Methods:** Children ( $n = 2693$ ) from 130 diverse, geographically distributed US communities reported participation in previous 7-day walking/bicycling. Mixed model ANOVAs were used to compare walking/bicycling by region, gender and age groups using Healthy Communities Study data.

**Results:** Walking/bicycling for fun/exercise was higher in the Midwest, South and West compared with the Northeast, with the same regional patterns for boys, girls and 9–11-year olds. Walking/bicycling to non-school destinations was higher in the Midwest compared with the South and Northeast, with the same pattern for girls and 9–11-year olds. Walking/bicycling to school was higher Midwest, Northeast and West compared with the South, with similar patterns for girls and 12–15-year olds.

**Conclusions:** Walking/bicycling for fun/exercise and to non-school destinations had higher prevalence than active transport to school. The Northeast reported lower walking/bicycling for fun/exercise; the South and Northeast reported lower walking/bicycling to non-school destinations. Program/policy initiatives should consider contextual demographic influences, as well as purpose/destination of walking/bicycling.

What is known:

- Children and adolescents are less active than recommended.
- In the USA, regional disparities exist in obesity and physical activity.
- Walking and bicycling for recreation and for active transport have potential for positive public health impact.

What this study adds:

- There is regional variation in the prevalence of walking and bicycling to school and other destinations and for fun or exercise.
- Walking and bicycling to school settings was less prevalent than walking and bicycling to other settings and for fun or exercise.
- Based on regional gender and age patterns, there appears to be more complexity in factors influencing active transport than recreational walking or bicycling.

**Keywords:** Active transport, bicycling, children, walking.

## Introduction

Public health concern about child obesity arises from its high prevalence (16.9%) (1) and association with adult obesity and chronic disease (2). Physical activity has been consistently associated with preventing excessive weight gain in youth (3), and children and adolescents who engage in regular physical activity experience numerous physical and mental health benefits (4). Yet youth are consistently less physically active and more sedentary than currently recommended (5,6) and become increasingly less active as they mature (7). The resulting complex public health challenge has serious implications for health in childhood, adolescence and adulthood. Furthermore, there is evidence for regional disparities in obesity (8,9) and physical activity among youth (10,11), as well as adults (11) in the USA, but few recent studies have examined regional differences. This information would enable regions, states and localities to develop more informed, targeted interventions, policies and environmental change, thereby potentially increasing their public health impact (8–11).

Promoting physical activity through walking and active transport is a US national priority, as reflected in the Surgeon General's Call to Action to Promote Walking and Walkable Communities (12), Healthy People 2020/Physical Activity Guidelines (13) and Objectives (i.e. Objectives 13–2 and 14.2) (14), National Physical Activity Plan (15) and Safe Routes to School Partnership (16). Walking or bicycling for active transport to non-school destinations and for fun and exercise are among the most commonly reported forms of physical activity among boys and girls (17,18) and thus is a highly accessible form of physical activity with large potential for public health impact. Walking or bicycling to school is less prevalent but has many potential benefits (19). Little is known about regional variations in bicycling and walking for fun or exercise, to school, or to non-school destinations.

The Healthy Communities Study (HCS), which systematically examined the impact of federal, state and local 'natural experiments' to address obesity through policy and environmental change (20), provided a unique opportunity to examine prevalence of specific types of physical activity in a nationally distributed sample of US youth. Specifically, the HCS data afford an opportunity to examine regional variations in walking and bicycling. Accordingly, the primary purpose of this study was to examine regional variations in previous 7-day participation in walking or bicycling to school and other destinations and walking or bicycling for fun or exercise overall and among boys and girls

and youth ages 9–11 and 12–15 years old in geographically distributed community settings in the USA.

## Methods

### Study data

The data for this cross-sectional and descriptive study were obtained from the HCS. Detailed methods have been previously reported (20–23) and are summarized here.

### Sampling and procedures

The HCS used a hybrid sampling strategy to select 130 communities across the USA; some were selected via a stratified national probability-based sample, and some because they had implemented promising programs and policies targeting child obesity (21). The resulting sample was not representative nationally but, rather, was composed of communities that were widely distributed around the USA. In each selected community, up to 81 children and adolescents along with their parents/caregivers were recruited in grades K-8 from two public elementary and two public middle schools ( $n = 5138$  youth) (20,21).

Physical activity data were collected between October 2013 and August 2015 in all regions simultaneously by trained field data collectors (20,23). Specific dates for data collection are not available; however, simultaneous data collection reduced the risk of confounding because of seasonal effects on physical activity. Child physical activity measures were completed on tablet computers in the home by children ages 9 to 15, with parental assistance for children ages 9 to 11, as needed (23). The study was approved by the Battelle Memorial Institute IRB, and parents provided written informed consent for their child's participation (22).

### Participants

The 2693 participants in this study, described in Table 1, included HCS youth who were 9–15 years of age. Two thousand one hundred ninety six of the 5138 HCS participants were less than 9 years of age and were excluded because physical activity information was surrogate-reported vs. self-reported. An additional 249 participants did not respond to key questions (note that some participants were missing multiple items); missing data include ethnicity = 77, family income = 205, walk to non-school destinations = 29, walk for fun or exercise = 38 and walk to school = 35.

**Table 1** Demographics of total sample (n = 2693)

	Total sample		Midwest (IA, IL, IN, KS, MI, MO, MN, ND, NE, OH, SD, WI)		Northeast (CT, MA, ME, NH, NJ, NY, PA, RI, VT)		South (AR, DE, DC, AL, FL, GA, KY, LA, MD, MS, NC, OK, TN, TX, SC, VA, WV)		West (AK, CO, AZ, CA, HI, ID, MT, NM, NV, OR, UT, WA, WY)		Regional diff.	p value
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent		
Child-level characteristics												
Family income <\$35 000	1388	51.5	261	49.5	213	55.0	596	54.0	318	47.0		.012
Yes												.767
Age group												
Younger (9–11 years)	1502	55.8	292	55.4	210	54.3	628	56.9	372	55.0		
Older (12–15 years)	1191	44.2	235	44.6	177	45.7	475	43.1	304	45.0		.789
Sex												
Male	1310	48.6	249	47.3	188	48.6	534	48.4	339	50.2		
Female	1383	51.4	278	52.8	199	51.4	569	51.6	337	49.9		<.0001
Race												
White	1568	58.2	287	54.5	185	47.8	664	60.2	432	63.9		
African American	525	19.5	132	25.1	94	24.3	262	23.8	37	5.5		
Multiple	116	4.3	30	5.7	21	5.4	31	2.8	34	5.0		
Other	126	4.7	23	4.4	17	4.4	38	3.5	48	7.1		
Unknown	358	13.3	55	10.4	70	18.1	108	9.8	125	18.5		<.0001
Ethnicity												
Hispanic	1230	45.7	142	26.9	177	45.7	518	47.0	393	58.1		
Non-Hispanic	1463	54.3	385	73.1	210	54.3	585	53.0	283	41.9		
Children by community-level characteristics												
Regions												
Census tract urbanicity												
Rural	596	22.1	58	11.0	69	17.8	375	34.0	94	13.9		<.0001
Suburban	1085	40.3	229	43.5	181	46.8	419	38.0	256	37.9		
Urban	1012	37.6	240	45.5	137	35.4	309	28.0	326	48.2		<.0001
Census tract minority classification												
African American	542	20.1	168	31.9	50	12.9	309	28.0	15	2.2		

(continues)

Table 1 (Continued)

	Total sample	Midwest (IA, IL, IN, KS, MI, MO, MN, ND, NE, OH, SD, WI)	Northeast (CT, MA, ME, NH, NJ, NY, PA, RI, VT)	South (AR, DE, DC, AL, FL, GA, KY, LA, MD, MS, NC, OK, TN, TX, SC, VA, WV)	West (AK, CO, AZ, CA, HI, ID, MT, NM, NV, OR, UT, WA, WY)	Regional diff.
Hispanic	1140	157	156	471	356	52.7
Other	1011	202	181	323	305	45.1
Percent of community with poverty status	21.1	21.8	21.3	22.7	17.4	<.0001 <sup>6</sup>

## Measures

As previously reported (23), the 7-day Physical Activity Behavior Recall instrument was used to collect self-reported physical activity. This study focused on any participation (yes/no) for three mutually exclusive behaviours: walking or bicycling for fun or exercise; walking or bicycling for active transport to or from a store, park, playground or friend's house and walking or bicycling to or from school over the prior 7 days.

## Data analysis

We examined overall regional differences in child-level and community-level demographics using chi-squared tests. For each behaviour in the primary analysis, we made overall (i.e. not region-based) gender and age group comparisons for participation of walking or bicycling for fun or exercise, walking or bicycling to non-school destinations and walking or bicycling to/from school using logistic regression (Proc Glimmix). We examined regional differences in overall participation of walking or bicycling for fun or exercise, walking or bicycling to non-school destinations and walking or bicycling to/from school for the total sample, by gender and by age group (9–11-year olds and 12–15-year olds) using a mixed model ANOVA for each behaviour that included a random effect to account for variation between communities, while adjusting for family income, race, ethnicity, urbanicity and community poverty for all analyses and sex and age group as appropriate to each specific analysis (i.e. did not adjust for sex in gender comparison or age group in age group comparisons).

## Results

### Demographics

Based on HCS regional classification (19), around 41% of participants resided in the South, 25% in the West, 20% in the Midwest and 14% in the Northeast. Slightly more than half of the youth in the sample were female, and around 56% were 9–11-year olds; there were no overall regional variations in sex or age group distributions. Slightly more than half of the families reported an income of less than \$35 000 with significant overall regional variation (Table 1). The Northeast and South compared with the West appeared to have more family income levels less than \$35K. Similarly, the West compared with the other regions appeared to have a lower percentage of population with poverty status in community.

Around 58% reported race as white, 20% reported race as African American, 4% reported race as multi-race and 5% as other; race is unknown for about 13%,

with significant overall regional variations in race (Table 1). The West compared with all other regions appeared to have a lower percentage of African American participants. About 54% of the sample reported ethnicity as non-Hispanic, with significant overall regional variation. The Midwest reported fewer and the West reported more participants classified as Hispanic. There was also significant overall regional variation in urbanicity (Table 1). Communities in the South compared with other regions appeared to be more rural and less urban.

### Previous 7-day participation in walking or bicycling for fun or exercise overall and by region, gender and age group

Nearly 60% of all participants reported participation in walking or bicycling for fun or exercise during the previous 7 days (Table 2). There were no significant differences between boys and girls ( $p = .07$ ), but significantly more 9–11-year olds compared with 12–15-year olds reported previous 7-day participation ( $p = .002$ ). Participation was significantly higher in the Midwest, South and West compared with the Northeast (Table 2). The percentage of respondents reporting participation ranged from about 48% in the Northeast, 58% in the South, to about 63% and 64% in the Midwest and West.

For boys, previous 7-day participation in walking or bicycling for fun or exercise was significantly higher in the Midwest, South and West (range about 56 to 65%) compared with the Northeast (about 47%). For girls, previous 7-day participation in walking or bicycling for fun or exercise was significantly higher in the Midwest, South and West (range about 60 to 67%) compared with the Northeast (about 50%) (Table 2).

For 9–11-year-old respondents, participation in walking or bicycling for fun or exercise was significantly higher in the Midwest, South and West (about 61–69%) compared with the Northeast (51%). For 12–15-year-old respondents, participation in walking or bicycling for fun or exercise was significantly higher in the West (64%) compared with the Midwest, Northeast and South (about 45–55%). It was also higher in the Midwest and South (about 55% each) compared with the Northeast (45%).

### Previous 7-day participation in walking or bicycling to non-school destinations overall and by region, gender and age group

Half of all respondents reported participation in walking or bicycling to non-school destinations over the

**Table 2** Regional comparisons of walking or bicycling for fun or exercise in the past 7 days

	Total Sample			Midwest			Northeast			South			West			$p$
	$n$	Freq.	Yes	$n$	Freq.	Yes	$n$	Freq.	Yes	$n$	Freq.	Yes	$n$	Freq.	Yes	
Total*	2693	1595	59.2	527	333	63.2 <sup>a</sup>	387	187	48.3	1103	641	58.1 <sup>a</sup>	676	434	64.2 <sup>a</sup>	<.01
Boys <sup>†</sup>	1310	753	57.5	249	146	58.6 <sup>a</sup>	188	88	46.8	534	299	56.0 <sup>a</sup>	339	220	64.9 <sup>a</sup>	<.05
Girls <sup>†</sup>	1383	842	60.9	278	187	67.3 <sup>a</sup>	199	99	49.8	569	342	60.1 <sup>a</sup>	337	214	63.5 <sup>a</sup>	<.05
9–11 years <sup>‡</sup>	1502	928	61.8	292	202	69.2 <sup>a</sup>	210	108	51.4	628	381	60.7 <sup>a</sup>	372	237	63.7 <sup>a</sup>	<.05
12–15 years <sup>‡</sup>	1191	667	56.0	235	131	55.7 <sup>a</sup>	177	79	44.6	475	260	54.7 <sup>a</sup>	304	197	64.8	<.05

Values across a row that do not share a superscript letter are significantly different.

\*Analyses adjusted for sex, age group, family income, race, ethnicity, urbanicity and community poverty.

<sup>†</sup>Analyses adjusted for age group, family income, race, ethnicity, urbanicity and community poverty.

<sup>‡</sup>Analyses adjusted for sex, family income, race and ethnicity, urbanicity and community poverty.

previous 7 days (Table 3). Boys and girls did not differ significantly ( $p = .37$ ), but more 12–15-year olds compared with 9–11-year olds youth reported participation in walking or bicycling to non-school destinations ( $p = .02$ ). For all respondents, previous 7-day walking or bicycling for active transport to non-school destinations was significantly higher in the Midwest (about 58%) compared with the South and Northeast (around 46% each) (Table 3).

For boys, significantly more participants in the West (55%) compared with the Northeast (45%) and South (47%) reported participation in walking or bicycling for active transport to non-school destinations, whereas for girls, it was significantly higher in the Midwest (about 60%) compared with other regions (around 45 to 49%) (Table 3). For 9–11-year-old respondents, the participation in walking or bicycling to non-school destinations was significantly higher in the Midwest (about 59%) compared with the South and the Northeast (42 and 44%). For 12–15-year-old respondents, there were no significant regional differences in walking/bicycling for transportation (49 to 57%) (Table 3).

### Previous 7-day participation in walking or bicycling to school overall and by region, gender and age group

Slightly over one-quarter of all respondents reported participation in walking or bicycling to school over the previous 7 days. There were no significant differences by gender or age group ( $p = .40$  and  $.65$  respectively) (Table 3). For the total sample, fewer respondents in the South (18%) reported active transport to school compared with other regions (range 26–36%).

The same regional pattern held for girls (about 17% in the South compared with 28 to 34% in other regions) and for 12–15-year olds (about 17% in the south compared with 27 to 38% in other regions). Boys in the South and West differed (about 20 and 37% respectively), and fewer 9–11-year olds in the South compared with Midwest (30%) and West (33%) reported walking or bicycling to school (Table 3).

## Discussion

### Contribution of this study

The importance of physical activity among youth, especially walking and active transport, is recognized as a public health priority in the USA (12–16) and globally (24). A more complete understanding of geographic variations in common physical activity behaviours, walking or bicycling for fun or exercise

and for active transport to non-school and school destinations, would enable the development of more targeted physical activity programs and policies. Towards these ends, the unique contributions of this study are the (i) description of walking or bicycling among 9–15-year olds for multiple purposes in a diverse and geographically distributed sample of US communities and (ii) examination of regional variations overall and by gender and age groups.

### Nationally distributed sample

Walking or bicycling for fun or exercise and for active transport to non-school destinations was fairly common in this nationally distributed US sample. These results are comparable with previous reports (17,18). These population levels of participation in walking or bicycling for fun or exercise leave room for improvement, especially given accessibility of these activities to broad segments of the population and the potential for public health impact.

Active transport to school was less common in the nationally distributed sample (around 25%). This is consistent with Yang and colleagues (25), but somewhat higher than other reports (11,26) and much lower than reports from other countries (27,28). Clearly, this level of participation affords room for improvement, and current efforts are underway to increase active transport to school (15,16). There is also potential for increased physical activity via comprehensive planning to integrate walking with bus or light rail transport (29). The national US view is informative; however, an examination of regional variations and considering variations by gender and age group presents a more nuanced picture and may be useful for more targeted regional, state and local strategies to promote physical activity in youth.

### Regional patterns

Unique findings of this study are that Northeast youth overall report lower participation in bicycling for fun or exercise compared with other regions, youth in both the Northeast and South reported lower walking or bicycling for active transport to non-school destinations and youth in the South reported lower participation for walking or bicycling to/from school compared with other regions. These results are partially consistent with regional variations reported by Yang and colleagues (11) and by Singh and colleagues (10).

It is important to note that there were regional variations in demographics including income and poverty, race and ethnicity and urbanicity. Study communities in the West appeared to be higher in family income and lower in community poverty status, whereas

**Table 3** Regional comparisons of walking or bicycling to non-school and school destinations in the past 7 days

	Total sample			Midwest			Northeast			South			West			
	n	Freq.	Percent yes	n	Freq.	Percent Yes	n	Freq.	Percent Yes	n	Freq.	Percent Yes	n	Freq.	Percent Yes	p
<b>Non-school destinations</b>																
Total*	2693	1343	49.9	527	307	58.3 <sup>a</sup>	387	179	46.3 <sup>b</sup>	1103	508	46.1 <sup>b</sup>	676	349	51.6 <sup>a</sup>	<.05
Boys <sup>†</sup>	1310	665	50.8	249	140	56.2 <sup>a</sup>	188	85	45.2 <sup>b</sup>	534	253	47.4 <sup>b</sup>	339	187	55.2 <sup>a</sup>	<.05
Girls <sup>‡</sup>	1383	678	49.0	278	167	60.1	199	94	47.2 <sup>a</sup>	569	255	44.8 <sup>a</sup>	337	162	48.1 <sup>a</sup>	<.01
9–11 years <sup>‡</sup>	1502	720	47.9	292	173	59.3 <sup>a</sup>	210	89	42.4 <sup>b</sup>	628	276	44.0 <sup>b</sup>	372	182	48.9 <sup>a,b</sup>	<.01
12–15 years <sup>‡</sup>	1191	623	52.3	235	134	57.0 <sup>a</sup>	177	90	50.9 <sup>a</sup>	475	232	48.8 <sup>a</sup>	304	167	54.9 <sup>a</sup>	NS
<b>School destination</b>																
Total*	2693	712	26.4	527	149	28.3 <sup>a</sup>	387	121	31.3 <sup>a</sup>	1103	202	18.3	676	240	35.5 <sup>a</sup>	<.05
Boys <sup>†</sup>	1310	356	27.2	249	70	28 <sup>a</sup>	188	56	29.8 <sup>a</sup>	534	106	19.9	339	124	36.6 <sup>a</sup>	<.01
Girls <sup>‡</sup>	1383	356	25.7	278	79	28.4 <sup>a</sup>	199	65	32.7 <sup>a</sup>	569	96	16.9	337	116	34.4 <sup>a</sup>	<.01
9–11 years <sup>‡</sup>	1502	392	26.1	292	88	30.1 <sup>a</sup>	210	58	27.6 <sup>a</sup>	628	122	19.4	372	124	33.3 <sup>a</sup>	<.05
12–15 years <sup>‡</sup>	1191	320	26.9	235	61	26.0 <sup>a</sup>	177	63	35.6 <sup>a</sup>	475	80	16.8	304	116	38.2 <sup>a</sup>	<.01

Values across a row that do not share a superscript letter are significantly different.

\*Analyses adjusted for sex, age group, family income, race, ethnicity, urbanicity and community poverty.

†Analyses adjusted for age group, family income, race, ethnicity, urbanicity and community poverty.

‡Analyses adjusted for sex, family income, race and ethnicity, urbanicity and community poverty.

study communities in the South appeared to be lower in family income and higher in community poverty status. The South appeared to be more rural and less urban compared with the other regions. These factors could account for some variation in regional patterns. However, regional disparities remained in our study after adjusting for family income, race, ethnicity, urbanicity and community poverty for all analyses. It is possible that the statistical adjustments did not fully address regional differences. For example, active transport to school and non-school destinations in the South may be lower because the South is more rural (e.g. no sidewalks and greater distances between home and other locations) (11). Understanding the patterns in the Northeast, which was higher on active transport to school but lower on prevalence of walking and bicycling for fun or exercise and active transport to other destinations, is more challenging based on sociodemographic characteristics, as no clear pattern emerges. There are also no clear, descriptive sociodemographic patterns that clarify the overall greater prevalence of walking or bicycling in the Midwest and West. Future research should explore region-specific explanatory factors.

Seasonality may be an important influence on physical activity including active transport. Even though simultaneous data collection in all regions reduced the risk of confounding because of seasonality, it is possible that seasonal effects played a role (11).

Walking or bicycling for fun or exercise showed consistent geographic patterns by gender and for younger youth; however, the geographic pattern for older youth was more varied. This variability is consistent with previously reported developmental differences in physical activity (30). There were variations for geographic patterns in walking or bicycling for transportation to school and non-school destinations by gender and age groups, indicating more complexity. For example, it is possible that gender-based variations in prevalence of walking or bicycling for active transport to non-school destinations within a region could reflect gender-specific social influences and/or gender-based differences in reactions to the built environment. Furthermore, physical and social environments may be linked, making it important to consider and address multilevel elements of both program and policy initiatives, as well as built environment, sociodemographic and social environment factors.

Our results suggest that it is important for regional, state and local change initiatives to consider demographic characteristics (gender), the specific purpose of the activity (active transport vs. recreation), specific destination (school vs. non-school) for active transport as well as both the social and

physical environments in which these behaviours take place. Walking or bicycling for fun or exercise, walking or bicycling to non-school destinations and walking or bicycling to school are separate physical activity behaviours, each contextually bound with differing salient features depending on gender and age. These results provide practical region-specific information that practitioners can apply, in conjunction with the recommendations in the Surgeon General's Call to Action to Promote Walking and Walkable Communities (12), National Physical Activity Plan (15) and Safe Routes to School Partnership (16), to promote population physical activity among youth and achieve the goals and objectives of Healthy People 2020 and the Physical Activity Guidelines (13,14).

### Limitations and strengths

Limitations of this study include the use of self-reported physical activity behaviour, cross-sectional design and limited information on time of data collection. Strengths include a sample of diverse and geographically distributed communities in the USA and the ability to examine specific physical activity behaviours by region. To our knowledge, this study is one of the first to examine regional variations in walking and bicycling for multiple purposes and to consider regional variations by gender and age groups.

### Conclusions

Walking or bicycling for fun or exercise and to non-school destinations was reasonably prevalent in this sample, whereas fewer respondents reported active transport to school in the previous 7 days. Regional examination revealed that walking or bicycling for fun or exercise were lower in the Northeast, walking or bicycling for active transport to non-school destinations was lower in the South and Northeast and walking or bicycling to school was lower in the South. Variability in regional patterns by gender and age group was greater for active transport than for walking or bicycling for fun or exercise, suggesting more complexity in factors influencing active transport. Regional patterns by gender were consistent for recreational activity, whereas age-related patterns reflected aged-related developmental declines in physical activity. There was more variability in regional pattern by gender and age group for active transport.

Programs and policies designed to create opportunities and promote walking or bicycling in youth should consider the purpose (recreational or active transport) and for active transport, the destination (school or non-school) of the activity, as well as demographic,



social and contextual/environmental factors that vary regionally. These results provide practical information that can be applied, in conjunction with current efforts of national and government partnerships, to promote physical activity in the US population of youth.

## Conflict of interest statement

No conflict of interest was declared.

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## Author contributions

RP, KM and MD participated in HCS study conception and implementation; MD analysed data; all authors conceived specific study reported in manuscript based on HCS secondary data, and all authors were involved in writing the paper and had final approval of the submitted and published versions.

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