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What is the relationship between menstruation-related restrictions and menstrual health and hygiene management? A mixed method, community-based, cross-sectional study in rural India

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Abstract: *The objective of the research was to test the relationship between restrictions and menstrual health and hygiene management (MHHM). A total of 2,212 adolescents in the structured questionnaire and 309 adolescent girls in the focus group discussions (FGDs) were selected using stratified random sampling in three districts of Uttar Pradesh. Overall, 96 per cent of the adolescent girls mentioned they faced some restriction in the structured questionnaire. Factors affecting adequate preparation of clean absorbent included having food restrictions and not having personal and structural restrictions. Factors affecting adequate storage of clean absorbent included not having social/religious restrictions and having structural restrictions. Factors affecting adequate frequency of changing included not having personal restrictions. Factors affecting adequate disposal included not having structural restrictions. The FGDs and structured questionnaire demonstrated that restrictions were ubiquitous, and adolescent girls followed restrictions because of personal and social beliefs, including considering menstruation impure. There was a blurry distinction between personal and social restrictions and most FGDs could not articulate actions to overcome social restrictions. These results highlight that restrictions matter and have a relationship with adequate MHHM. There is a need to combat restrictions using multifaceted approaches by designing programmes that are context specific.*

Keywords: restrictions, menstrual health and hygiene management, menstrual hygiene management, adolescent girls, taboos

The relationship between menstruation-related restrictions and menstrual health and hygiene management (MHHM) is unknown and understudied (Bobel, 2019). Although menstruation-related restrictions are prevalent around the world at different levels, the fact that restrictions inhibit an individual from living with dignity and having agency is an important human rights dimension that needs to be considered (Farage et al., 2011; Winkler, 2019). Most studies in the literature have been descriptive in nature (only reporting proportions) and have not assessed

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the relationship between restrictions and all MHHM behaviours (Farage et al., 2011; Bhattacherjee et al., 2013; Juyal et al., 2013; Mehta et al., 2013; Misra et al., 2013; Shankaraiah et al., 2013; Shridevi and Padma, 2013; Verma et al., 2013; Arumugam et al., 2014; Chothe et al., 2014; Jain et al., 2014; Paria et al., 2014; Patle and Kubde, 2014). The justification for looking at the relationship between menstruation-related restrictions and MHHM is twofold. First, there is a direct relationship between health and human rights (Mann, 1996; Winkler, 2019). Mann (1996) outlined that using the human rights framework takes precedence over other frameworks when analysing and intervening with public health challenges. Second, studies have demonstrated that menstruation is a taboo across the world and most women who face menstruation-related restrictions have a negative relationship with specific behaviours pertaining to MHHM; that is, bathing, storage of absorbent, cleaning and drying the absorbent, and disposal (Kumar and Srivastava, 2011; Garg et al., 2012; Shah et al., 2013; Sumpter and Torondel, 2013; Das et al., 2015; Sahoo et al., 2015; Sommer et al., 2015a; Varghese et al., 2015). However, none of the studies has looked at all behaviours of MHHM in their analyses.

The objective of the research was to test the relationship between restrictions and MHHM in Uttar Pradesh, India among a large sample of adolescent girls. We hypothesize a negative relationship between menstruation-related restrictions and MHHM behaviour, which informs our methods and analyses. Since restrictions are context specific, this study only focuses on restrictions in India. However, findings of this study could aid in other settings since we look at a more holistic view of restrictions as personal, social, and structural limitations. Other settings have outlined structural and social barriers when trying to practise adequate MHHM behaviours in the realms of education and water, sanitation, and hygiene (Mahon and Fernandes, 2010; Sumpter and Torondel, 2013; Sommer et al., 2015b; UNDP, 2015; UNICEF, 2015).

Literature review

Menstruation-related restrictions increase poor hygiene behaviours, nutritional deficiencies, gender inequality, marginalization, and isolation (Narayan et al., 2001; Arumugam et al., 2014; UNICEF, 2015; van Eijk et al., 2016). Menstruation is a taboo topic, related to uncleanliness and impurity (Dasgupta and Sarkar, 2008; Yagnik, 2012; Sumpter and Torondel, 2013; Kaundal and Thakur, 2014; Thakur et al., 2014; Garg and Anand, 2015; van Eijk et al., 2016). As a result, communication around menstruation is limited in the community, which eventually has an effect on adolescent girls' ability to live with dignity during menstruation (Yagnik, 2014; Winkler, 2019). The concept of restrictions has been avoided in MHHM programming, due to its distal nature and deeply ingrained social norms, which requires intervening at all levels of the socio-ecological model (Bobel, 2019).

Although menstruation-related restrictions are considered as taboos within the literature, we define restrictions as 'a limitation during menstruation, which can be imposed personally, socially, and structurally' (Ramaiya, 2018). We take this approach because, when making programmatic decisions and recommendations,

we are able to specifically focus on those areas. Whereas taboos are socially enforced and considered normative, restrictions include personal norms, social norms, and structural barriers (Mackie et al., 2015). Personal norms are self-imposed restrictions (Mackie et al., 2015). Social norms are 'what people in a particular group believe to be normal or a typical action' (Mackie et al., 2015: 10). Structural barriers are factors that are unmodifiable at the individual level and part of the environment (Altheide, 1999; Latkin et al., 2010). We use the word restrictions in the context of limitations imposed during menstruation from this point forward.

At the overall level, a systematic review in India demonstrated that restrictions were imposed on 90 per cent (95 per cent CI: 79–96 per cent) of adolescent girls in rural areas (van Eijk et al., 2016). The relationship between restrictions and MHHM has been limited within literature. Studies have shown how restrictions negatively predict: 1) bathing among certain religions (Kumar and Srivastava, 2011); 2) storage of absorbent (Garg et al., 2012); and 3) cleaning and drying of absorbent with soap and water (Shah et al., 2013; Sumpter and Torondel, 2013; Das et al., 2015). Narayan et al. demonstrated that higher 'traditionality' (adherence to taboos) correlated with lower menstrual hygiene in Tamil Nadu, south India (Pearson correlation = –0.24, $p < 0.01$) (Narayan et al., 2001).

A total of three studies demonstrated a relationship between structural barriers and MHHM (Shah et al., 2013; Sahoo et al., 2015; Varghese et al., 2015). In a community-based study in Odisha, women/adolescent girls described walking a distance in order to find private, clean places for managing their menstruation during work; private/public facilities were deemed dirty, lacking bathing/changing rooms, and having limited hours of operation (Sahoo et al., 2015). Another study in Gujarat among tribal adolescent girls showed very few participants had a bathroom for washing their cloths and, as a result, most washed them in a designated open place. Furthermore, adolescent girls dried their cloths in dark, damp, and dusty places. In terms of access, toilets were non-existent in farms, where they worked, and at schools. If toilets were present, there was a lack of running water. Adolescent girls voiced concern about inadequate facilities for garbage collection or incinerators in schools and villages for sanitary pads, leading them to store their used sanitary pads for the period of an entire menstrual cycle and then disposing through other mechanisms (Shah et al., 2013). Lastly, a study among schoolgoing adolescent girls aged 13–18 years demonstrated that those who had access to a covered toilet had a significantly higher prevalence of MHHM ($p < 0.01$) (Varghese et al., 2015).

Determinants of restrictions and MHHM include area and caste. A systematic review demonstrated that adolescent girls in urban settings had a higher proportion of commercial pad use versus cloth, and disposal through waste and burning versus burying and throwing away in public spaces (van Eijk et al., 2016). There was no significant difference between urban and rural areas in terms of having a daily bath during menstruation (van Eijk et al., 2016). Adolescent girls in rural areas had a significantly higher proportion of restrictions versus adolescent girls in urban areas (90 per cent versus 83 per cent) (van Eijk et al., 2016). A study in Rajasthan, India demonstrated that adolescent girls from general caste had 1.8 times greater odds of adequate menstrual practices in comparison with adolescent girls from scheduled

caste/scheduled tribe (Khanna, 2005). Restriction practices varied by caste, with the higher castes adhering to a higher number of restrictions compared with lower castes (Posner et al., 2009).

Methods

Theoretical approach

The operationalization of restrictions based on the literature was not theoretically guided but aided in comparing the proportions and factors of this study to those within the literature.

We used a theoretical-based operationalization of restrictions by using the constructs of personal norms, social norms (taboos), and structural barriers from norm activation theory, social norms theory, and socio-ecological framework, respectively, to define restrictions as 'a limitation during menstruation, which can be imposed personally, socially and/or structurally, separately' (Ramaiya, 2018). Table 1 outlines the theoretical constructs and definitions of these three restrictions.

Study design, setting, and participants

The GARIMA intervention was a social and behavioural change multimedia programme to make MHHM a normal experience. The intervention was implemented in three districts of Uttar Pradesh (Mirzapur, Jaunpur, and Sonbhadra)

Table 1 Theoretical constructs and definitions for 'restrictions'

Construct	*Definition*	*Application to restrictions*	*Theories*
Personal norms	'Personal norm or a personal attitude is internally motivated and is distinct from a social norm which is, one way or another, externally motivated' (Mackie et al., 2015: 10).	Personal restrictions are those that are imposed on oneself, based on personal attitude and motivation. For example, the adolescent girl does not practise adequate MHHM because her body is aching.	Norm activation theory (Schwartz, 1973)
Social norms	Injunctive norm: 'Belief about whether most people approve or disapprove of the behavior' (Montano and Kasprzyk, 2008: 74). Descriptive norm: 'Belief about whether most people perform the behavior' (Montano and Kasprzyk, 2008: 74).	Social restrictions are those that are imposed by other people, based on the belief that menstruation is a taboo. For example, the adolescent girl does not dry her cloth in the sun because her father said no.	Social norms theory (Cialdini et al., 1990)
Structural barriers	'The socio-ecological framework believes that behavior is based on the physical environment, social environment and personal attributes' (Sallis et al., 2008: 469). The organizational level realm would encompass the structural barriers.	Structural restrictions are those that are imposed by the environment and cannot be modified by the adolescent girl. For example, the adolescent girl uses her mother's saree cloth because sanitary pads are too expensive.	Socio-ecological framework (Sallis et al., 2008)

reaching about 64,000 adolescent girls across 1,975 villages between 2013 and 2016 (Ramaiya, 2018).

This study was a mixed method cross-sectional study, which included results from a household structured questionnaire with triangulation from focus group discussions (FGDs) in the three districts of Uttar Pradesh from December 2017 to January 2018. A total of 2,212 adolescent girls were selected randomly across 240 villages for the structured questionnaire and 309 adolescent girls were chosen purposively for the FGDs.

Data collection

The structured questionnaire and FGDs were translated into Hindi and pre-tested. The structured questionnaire had 13 sections. The items to create a MHHM scale and restriction scale were part of the behaviours and restriction sections, respectively. The questionnaire was completed by computer assisted personal interviewing by trained data collectors to increase inter-rater reliability and reduce non-response bias (Lavrakas, 2011a, b). A participatory free-listing activity related to restrictions labelled 'cannot do, will not do, and should not do' was conducted as part of the FGDs. Free-listing activities are simple methods of gaining insight into local terminology, feelings, and beliefs about concepts or phenomena.

Ethical considerations

The local research agency received approval from an independent Institutional Review Board (IRB) in India and the authors obtained approval from Drexel University for the endline. The objectives of the study were explained to every participant and if applicable to an adult caregiver before inclusion. Since literacy levels were low in the setting, the option of informed/verbal consent from adults (18 and over) and assent from the adolescent girl (under 18 years) coupled with consent from adults were obtained before inclusion.

Tool description

This section describes how MHHM and restrictions were operationalized and measured quantitatively and qualitatively.

Quantitative tool. The main dependent variables (behaviours comprising MHHM) were preparation of clean absorbent, storage of clean absorbent, frequency of changing the absorbent, disposal of the absorbent, and hygiene based on the MHHM definition (Ramaiya, 2018). Preparation of clean absorbent, storage of clean absorbent, disposal, and hygiene were ordinal (inadequate, semi-adequate, or adequate) and frequency of changing was dichotomous (inadequate or adequate) (Ramaiya, 2018). Preparation of absorbent was coded adequate if the adolescent girls used new cotton cloth every time they changed, used a disposable sanitary pad, or if the adolescent girls used old cotton cloth, which was washed with soap and water and/or other disinfectant, dried in the sunlight outside, and used exclusively.

Storage of absorbent was coded as adequate if adolescent girls stored the absorbent, along with other clothes for daily wear, in a safe, clean place, in a bag or in the cupboard, or if the adolescent girls stated they used sanitary pads and new cotton cloth every time they changed. Disposal was coded as adequate if the absorbent was burnt, stored and taken to the school incinerator, or buried in a pit. Hygiene was coded as adequate if adolescent girls had a separate bathing place at home which they considered private, used it normally and during menstruation for bathing, took a bath with soap and water regularly and during menstruation, and washed their hands with soap and water after changing the menstrual absorbent. Adequate frequency of changing was three or more times a day.

The independent variables were operationalized in two different ways: measurement based on literature and measurement based on theory. Restrictions based on literature included clothing, food, places, and social/religious activities. Theory-based restrictions included personal (will not), social (should not), and structural (cannot) restrictions. For restrictions based on literature and theory, dichotomous variables were created, with 0 indicating the restriction was present and 1 indicating the restriction was not present. All seven restrictions were kept separate as independent variables.

Qualitative tool. For the FGDs, we used community-based participatory research to involve the participants in the data collection process and in turn give them agency. The free-listing activity corresponded to the structured questionnaire and was called 'cannot do, will not do, and should not do'.

Analysis

This section outlines how the research question was analysed quantitatively and qualitatively.

Quantitative analysis. Univariate analysis was conducted to assess socio-demographics, socio-economics, restrictions based on literature, restrictions based on theory, duration since menarche, and behaviours comprising MHHM, stratified by district.

The MHHM scale was a multi-dimensional construct comprising five behaviours: preparation of clean absorbent, storage of clean absorbent, frequency of changing, disposal, and hygiene (Ramaiya, 2018).

Two bivariate analyses were conducted. The first bivariate analysis looked at the relationship between clothing, food, mobility, and social/religious restrictions and MHHM. The second bivariate analysis looked at the relationship between personal, social, and structural restrictions and behaviours comprising MHHM.

A multilevel logistic regression was conducted for all behaviours comprising MHHM since the outcomes were coded as ordinal or binary variables on Stata 14 (StataCorp, College Station, TX). The model looked at the relationship of restrictions based on literature and theory and MHHM.

Adjusted odds ratios (AOR) were reported with 95 per cent confidence intervals (95 per cent CI). If the 95 per cent CI included 1, the predictor was not considered significant. All analyses were conducted on Stata 14. Since the proportion of missing values was minimal (< 2 per cent), missing values were excluded from the analysis.

Qualitative analysis. Thematic analysis of the FGD activity 'cannot do, will not do, and should not do' was conducted. For the analysis, first, a list of all unique responses for restrictions was generated using grounded theory by adding similar responses from within and across FGDs together. Percentages at which these restrictions appeared across the FGDs were calculated. Thereafter, the most common social restrictions, why these social restrictions exist, and a list of actions to overcome social restrictions were counted.

Results

Univariate analysis of restrictions

Table 2 shows that there was approximately equal distribution of the respondents across districts; 97.06 per cent of the population was Hindu; 50.5 per cent were scheduled caste/scheduled tribe, and 40.05 per cent were 'other backward caste'. The average age of the adolescent girls was 16.24 years (SD: 1.81). On average, adolescent girls were in ninth grade (SD: 2.7). For housing, a little less than half the adolescent girls (47.11 per cent) lived in temporary housing. Lastly, about 99 per cent of the adolescent girls were unmarried. There were significant differences in religion, caste, age, education, and type of house between the three districts.

Overall, clothing, dietary, mobility, and social/religious restrictions were mentioned by 75.14 per cent, 62.25 per cent, 90.87 per cent, and 87.34 per cent of the adolescent girls, respectively. Personal, social, and structural restrictions were mentioned by 80.24 per cent, 47.92 per cent, and 5.83 per cent of adolescent girls, respectively. When combined, 96 per cent of adolescent girls faced some sort of restriction (not shown on table). There were significant differences in dietary restrictions, mobility restrictions, social/religious restrictions, social restrictions, and structural restrictions between the three districts.

Duration since menarche and behaviours comprising MHHM among adolescent girls were also calculated. Among this sample, 86.34 per cent of the adolescent girls had been menstruating for more than a year. For behaviours comprising MHHM adequate preparation of clean absorbent was 23.42 per cent, adequate storage of clean absorbent was 60.53 per cent, adequate frequency of changing was 63.79 per cent, adequate disposal was 40.55 per cent, and adequate hygiene was 47.78 per cent. There were significant differences in adequate preparation of clean absorbent, adequate frequency of changing the absorbent every day, adequate disposal, and adequate hygiene between the three districts.

Bivariate analysis of restrictions and MHHM

Table 3 looks at the relationship between literature-based restrictions and MHHM. Preparation of clean absorbent had a relationship with food and social/religious restrictions. Storage of clean absorbent had a relationship with food, mobility, and social/religious restrictions. Disposal had a significant relationship with all four restrictions and hygiene had a significant relationship with clothing and food restrictions.

Table 2 Characteristics of restrictions among adolescent girls in Uttar Pradesh

Characteristics	*Overall*	*Jaunpur*	*Sonbhadra*	*Mirzapur*	*p-value*
N	2,212	812	660	740	
Religion					
Non-Hindu (%)	2.94	2.83	1.52	4.32	0.01**
Hindu (%)	97.06	97.17	98.48	95.68	
Caste					
General caste (%)	9.45	12.07	6.06	9.59	0.002**
Scheduled caste/tribe (%)	50.50	49.01	50.61	52.03	
Other backward caste (%)	40.05	38.92	43.33	38.38	
Age (years)	16.24	16.43	16.16	16.12	0.001***
Education (grade)	9.14	9.56	8.78	8.99	0.001***
Type of house					
Kutcha (raw/temporary) (%)	47.11	29.06	75.61	41.49	<0.001***
Semi-*Pucca* (frame is concrete, but walls are raw/temporary) (%)	24.46	31.53	15.61	24.59	
Pucca (solid/concrete) (%)	28.44	39.41	8.79	33.92	
Marital status					
Married (%)	0.86	1.35	0.61	0.54	0.33
Unmarried (%)	98.87	98.40	99.24	99.05	
Other (%)	0.27	0.25	0.15	0.41	
Duration since menarche					
<1 year (%)	13.66	12.06	13.98	15.13	0.21
≥1 year (%)	86.34	87.94	86.02	84.87	
Restrictions based on literature					
Clothes (%)	75.14	74.26	74.85	76.35	0.62
Dietary (%)	62.25	59.85	60.30	66.62	0.01**
Mobility (%)	90.87	91.50	87.73	92.97	0.002**
Social/Religious (%)	87.34	85.96	86.06	90.0	0.03*
Restrictions based on theory					
Personal (%)	80.24	78.57	80.91	81.49	0.3
Social (%)	47.92	49.63	41.52	51.76	<0.001***
Structural (%)	5.83	6.65	3.48	7.03	0.01**
Behaviours comprising MHHM					
Adequate preparation of clean absorbent (%)	23.42	25.49	15.45	28.24	<0.001***
Adequate storage of clean absorbent (%)	60.53	58.99	61.21	61.62	0.35
Adequate frequency of changing absorbent every day (%)	63.79	59.73	69.09	63.51	0.001***
Adequate disposal (%)	40.55	38.30	48.18	36.22	<0.001***
Adequate hygiene (%)	47.78	64.29	49.85	59.32	<0.001***

Note: Significant difference between independent variable and district at * $p \leq 0.05$ level; ** $p \leq 0.01$ level; *** $p \leq 0.001$ level

Table 3 Bivariate analysis between clothing, food, mobility, and social/religious restrictions by MHHM

	Clothing restrictions (%)	*Food restrictions (%)*	*Mobility restrictions (%)*	*Social/religious restrictions (%)*
N	1,162	1,377	2,010	1,932
Preparation of clean absorbent				
Inadequate	52.89	50.40	51.99	51.97
Semi-adequate	24.43	24.47	24.48	25.57
Adequate	22.68	25.13 *	23.53	22.46***
Storage of clean absorbent				
Inadequate	22.44	21.06	22.79	23.14
Semi-adequate	17.33	18.08	17.56	17.81
Adequate	60.23	60.86*	59.65**	59.06***
Frequency of changing				
Inadequate	37.12	37.04	36.32	35.87
Adequate	62.88	62.96	63.68	64.13
Disposal				
Inadequate	35.08	34.13	34.53	34.63
Semi-adequate	26.90	29.77	26.22	26.35
Adequate	38.03***	36.09***	39.25***	39.03***
Hygiene				
Inadequate	35.74	33.33	35.77	35.71
Semi-adequate	15.82	16.63	15.72	15.58
Adequate	48.44***	50.04***	48.51	48.71

Note: Significant difference between independent variable and MHHM behaviour at * $p \leq 0.05$ level; ** $p \leq 0.01$ level; *** $p \leq 0.001$ level

Table 4 looks at the relationship between theory-based restrictions and MHHM. Preparation of clean absorbent had a significant relationship with personal and social restrictions. Storage of clean absorbent had a relationship with structural restrictions. Frequency of changing had a relationship with personal and social restrictions. Disposal had a relationship with personal and structural restrictions.

Multivariable analysis of restrictions and MHHM

Table 5 looks at the multivariable relationship of restrictions with five behaviours comprising MHHM. After controlling for all other factors, adolescent girls who did not have food restrictions had a 28 per cent lower odds (95 per cent CI: 12–39 per cent) of practising adequate preparation of clean absorbent in each village. Adolescent girls who did not have personal and structural restrictions had a 1.70 (95 per cent CI: 1.31–2.21) and 1.57 (95 per cent CI: 1.08–2.28) times greater odds of adequate preparation of clean absorbent compared with adolescent girls who had personal and structural restrictions, respectively, within each village.

Table 4 Bivariate analysis between personal, social, and structural restrictions by MHHM

	Personal restrictions (%)	*Social restrictions (%)*	*Structural restrictions (%)*
N	1,775	1,060	129
Preparation of clean absorbent			
Inadequate	53.92	50.85	55.04
Semi-adequate	24.0	21.23	29.46
Adequate	22.08**	27.23***	15.50
Storage of clean absorbent			
Inadequate	23.49	21.51	13.95
Semi-adequate	16.73	17.64	15.50
Adequate	59.77	60.85	70.54*
Frequency of changing			
Inadequate	37.86	32.83	42.64
Adequate	62.14**	67.17**	57.36
Disposal			
Inadequate	34.65	35.47	43.41
Semi-adequate	26.42	22.45	39.53
Adequate	38.93***	42.08	17.05***
Hygiene			
Inadequate	34.54	37.36	27.13
Semi-adequate	16.56	14.81	20.93
Adequate	48.90	47.83	51.94

Note: Significant difference between independent variable and MHHM behaviour at * $p \leq 0.05$ level; ** $p \leq 0.01$ level; *** $p \leq 0.001$ level

Factors of adequate storage of clean absorbent included social/religious restrictions and structural restrictions and village-level random effects. After controlling for other factors, adolescent girls who did not have social/religious restrictions had a 1.60 times greater odds (95 per cent CI: 1.12–2.8) of practising adequate storage of clean absorbent in each village. Adolescent girls who had no structural restrictions had a 38 per cent lower odds (95 per cent CI: 5–59 per cent) of storing their absorbent in a safe or clean place compared with adolescent girls who had structural restrictions in each village.

Factors of frequency of changing an absorbent three or more times a day included personal restrictions and village-level random effects. After controlling for other factors, adolescent girls who had no personal restrictions had a 44 per cent greater odds (95 per cent CI: 5–98 per cent) of changing their absorbent three or more times a day in each village.

Factors of adequate disposal included structural restrictions and village-level random effects. After controlling for other factors, adolescent girls who had no structural restrictions had a 1.92 times greater odds (95 per cent CI: 1.35–2.72) of practising adequate disposal compared with adolescent girls who had structural restrictions in each village.

Table 5 Multivariable analysis to understand the relationship between restrictions and MHHM (n = 2,174)[1]

Characteristics	*Adequate preparation of clean absorbent AOR (95% CI)*	*Adequate storage of clean absorbent AOR (95% CI)*	*Adequate frequency of changing AOR (95% CI)*	*Adequate disposal AOR (95% CI)*	*Adequate hygiene AOR (95% CI)*
Food restrictions					
No restrictions	0.72 (0.59–0.88)*	0.84 (0.68–1.03)	1.09 (0.86–1.38)	1.18 (0.97–1.44)	0.79 (0.64–0.97)*
Social/religious restrictions					
No restrictions	1.15 (0.83–1.60)	1.60 (1.12–2.80)*	0.75 (0.52–1.09)	1.25 (0.91–1.72)	0.86 (0.62–1.18)
Personal restrictions					
No restrictions	1.70 (1.31–2.21)***	1.14 (0.86–1.51)	1.44 (1.05–1.98)*	1.07 (0.83–1.39)	0.85 (0.64–1.12)
Structural restrictions					
No restrictions	1.57 (1.08–2.28)*	0.62 (0.41–0.95)*	1.34 (0.88–2.04)	1.92 (1.35–2.72)***	0.87 (0.59–1.27)
Caste					
General caste	1.0	1.0	1.0	1.0	1.0
Scheduled caste/tribe	0.61 (0.44–0.84)**	0.75 (0.54–1.06)	1.42 (0.97–2.06)	0.99 (0.72–1.35)	0.69 (0.49–0.97)*
Other backward caste	0.66 (0.48–0.90)*	0.79 (0.56–1.11)	1.03 (0.71–1.49)	1.23 (0.90–1.67)	0.67 (0.48–0.96)*
Age					
Years	0.93 (0.88–0.99)*	1.0 (0.95–1.07)	0.98 (0.92–1.06)	0.99 (0.93–1.05)	0.98 (0.92–1.04)
Education					
Grade	1.08 (1.04–1.13)***	1.05 (1.01–1.09)*	1.07 (1.02–1.12)**	1.09 (1.05–1.14)***	1.10 (1.06–1.15)***
Type of house					
Kutcha	1.0	1.0	1.0	1.0	1.0
Semi-*Pucca*	0.97 (0.77–1.21)	0.83 (0.65–1.05)	1.07 (0.82–1.40)	0.91 (0.73–1.14)	1.56 (1.24–1.96)***
Pucca	1.40 (1.12–1.76)**	0.93 (0.73–1.18)	1.09 (0.83–1.43)	0.85 (0.68–1.06)	3.27 (2.56–4.17)***
Random effects					
District > block > village variance	0.27 (0.16–0.46)***	0.28 (0.15–0.50)***	0.62 (0.46–0.84)***	0.23 (0.13–0.41)***	0.36 (0.21–0.59)***

Note: Significant difference between independent variable and MHHM behaviour at * $p \leq 0.05$ level; ** $p \leq 0.01$ level; *** $p \leq 0.001$ level

[1] Controlling for socio-demographics, socio-economics, duration since menarche, personal restrictions, social restrictions, structural restrictions, clothing restrictions, food restrictions, mobility restrictions, and social/religious restrictions and random effects for district, block, and village

Factors of hygiene included food restrictions and village-level random effects. After controlling for other factors, adolescent girls who had no food restrictions had a 21 per cent lower odds (95 per cent CI: 3–36 per cent) of practising adequate hygiene behaviours compared with adolescent girls who had food restrictions in each village.

Results from qualitative FGDs: 'cannot, will not, and should not'

A total of 36 FGDs were conducted with 309 participants. Each FGD had between 6 and 12 adolescent girls. Adolescent girls sat around a large piece of paper which had a sun and rays emanating out of it. The centre circle (sun) specified MHHM-related restrictions. The rays allowed the adolescent girls to create a free-list of all the specific MHHM restrictions they faced and space to write each restriction within the rays. As a group, the participants then identified whether each reported restriction was personal (will not do), social (should not do), or structural (cannot do) using different coloured markers. Reasons for the most common social restrictions and actions for overcoming them were sought. In general, there was an equal distribution of adolescent girls in the three districts. The average age of adolescent girls was 16 years. More than 90 per cent of the adolescent girls were Hindu and from a marginalized caste (Ramaiya, 2018).

The top five restrictions cited across the FGDs included touching pickle (97 per cent), eating sour food (83.3 per cent), conducting worship/*puja* (80.5 per cent), going to place of worship (72.2 per cent), and washing hair (66.67 per cent). Overall, 91.7 per cent, 100 per cent, and 86.11 per cent of the FGDs outlined personal, social, and structural restrictions, respectively. The three most common social restrictions included eating sour food (27.78 per cent), touching pickle (16.67 per cent), and cooking (11.11 per cent).

The top four reasons for practising social restrictions included excessive bleeding (38.89 per cent), the belief that food would get spoilt (25 per cent), menstruation is impure (19.44 per cent), and pain in the stomach (11.1 per cent). When asked about actions to overcome the social restrictions, most (66.67 per cent) of the FGD participants said doing nothing and 25 per cent of them mentioned trying to make family and others understand. The results suggest that although adolescent girls were able to articulate what restrictions they face, they were not able to explain what actions they would take to overcome the restrictions. This means that adolescent girls do not think about the impact of restrictions on their daily life and have internalized the restriction.

Discussion

We assessed the relationship between restrictions and MHHM among adolescent girls. The results showed that factors of adequate preparation of clean absorbent included having food restrictions and not having personal and structural restrictions. Factors of adequate storage of clean absorbent included not having social/religious restrictions and having structural restrictions. Factors of adequate frequency of changing included not having personal restrictions. Factors of adequate disposal included not

having structural restrictions. Lastly, factors of adequate hygiene included having food restrictions. The FGDs and structured questionnaire demonstrated that restrictions were ubiquitous, and the reasons adolescent girls followed restrictions were because of personal and social beliefs, including considering menstruation impure. Although theoretically we tried to differentiate the various restrictions within the structured questionnaires, the FGDs suggest the distinction between personal and social restrictions is blurred.

The results show that restrictions are ubiquitous and have a relationship with MHHM. Of the adolescent girls, 96 per cent said they had some form of restriction during menstruation in the structured questionnaire and all FGDs mentioned restrictions. The proportions for clothing, dietary, mobility, and social/religious restrictions were 75.14 per cent, 62.25 per cent, 90.87 per cent, and 87.34 per cent, respectively. A systematic review in India showed that, overall, 90 per cent of adolescent girls faced restrictions during menstruation in rural areas (van Eijk et al., 2016). Food restrictions had a prevalence of 38 per cent, mobility restrictions between 23 and 27 per cent, and social/religious restrictions were between 27 and 75 per cent (van Eijk et al., 2016). The proportions within this study are much higher than those reported within the literature because the literature reported a pooled proportion for all rural areas within India. Studies have demonstrated that there is a significant difference in restrictions between areas, with rural areas having a higher proportion of restrictions than urban areas. This highlights the importance of urban rural stratification (Thakre et al., 2011; Paria et al., 2014; van Eijk et al., 2016). The results from this study are only applicable to rural areas and show that although stratification by urban and rural area is important, it is also necessary to look within rural neighbourhoods.

Mostly, the findings demonstrated that reporting a lack of restrictions was significantly associated with adequate MHHM. These findings indicate the importance of addressing restrictions as a means to promote adequate MHHM. However, the distinction between whether the restriction was personal or social was blurred. Personal restrictions predicted adequate preparation of clean absorbent and adequate frequency of changing. Not having social/religious restrictions predicted adequate storage of clean absorbent. Other studies within the literature have also shown a negative relationship between restrictions and cleaning and drying of absorbent with soap and water (indicators of preparation of clean absorbent) and storage of cloth (Garg et al., 2012; Shah et al., 2013; Sumpter and Torondel, 2013; Das et al., 2015). It can be hypothesized that the number of times an absorbent is changed is primarily a personal decision, once access to absorbents, sanitation facilities, disposal mechanisms, and education is controlled for. Further analysis of the results showed that 95 per cent of the adolescent girls cited mobility restrictions as both personal and social in nature. Approximately 91.27 per cent and 90.28 per cent of the adolescent girls reported that social/religious restrictions were predominantly personal and social in nature, respectively. This demonstrates that although the structured questionnaire tried to differentiate between the different levels of the socio-ecological model, the differentiation between personal and social restrictions was blurred for some of the restrictions. The FGDs supported this thesis. Two of the

top four reasons for following social restrictions were excessive bleeding and pain in the stomach. These reasons are personal in nature.

Not reporting structural restrictions had a positive relationship with adequate preparation of clean absorbent and disposal. The literature has shown that adolescent girls in urban areas have better access to absorbents than adolescent girls in rural areas (Garg et al., 2012; Yagnik, 2012). In a qualitative study among tribal adolescent girls in Gujarat, adolescent girls mentioned inadequate facilities for incinerators in schools and villages for sanitary pad disposal, leading them to dispose through other mechanisms (Shah et al., 2013).

Recommendations span across all levels of the socio-ecological model. Although the results demonstrate that there is a blurry distinction between personal and social restrictions, it is important to disaggregate the results since what one girl considers a social restriction, another might label as personal. The findings highlight the need to assess restrictions by types as well as levels to understand the source of the restriction in future studies. Programmes need to be implemented with adolescent girls to reduce personal restrictions, which are dictated by the belief that menstruation is impure, by improving awareness and self-efficacy. There is a need to build skills of adolescent girls to recognize and distinguish between personal, social, and structural restrictions. Additionally, adolescent girls can serve as agents of change to address these restrictions collaboratively with family and community members. Future studies should assess the blurry distinction of personal and social restrictions in greater detail, using more robust qualitative methodology.

The results from this study also indicate that social restrictions might get internalized as personal restrictions. At the interpersonal level, family play an integral role in the adherence to taboos and behaviours related to MHHM among adolescent girls. The findings at the individual level may accentuate the importance of involving families as part of the programme and changing their knowledge, attitudes, interpersonal communication, and behaviours around menstruation and restrictions. It is also recommended that programmes focus on improving access to medical and home-based treatment since adolescent girls said that they follow restrictions because of excessive bleeding and pain in the stomach. Families can be involved in the programme by being beneficiaries and/or implementers.

At the community and environmental level, the findings of this study can help guide public health professionals in creating and evaluating programmes that reduce menstruation-related restrictions and improve MHHM behaviour. Strategies proposed by previous research to combat menstrual-related restrictions include counselling by health workers within the community when adolescent girls/women come with reproductive tract infections and community-based health education campaigns to increase awareness about the normality of menstruation (Garg and Anand, 2015). Additionally, this study's results suggest that environmental factors are critical for practising adequate preparation of clean absorbent and disposal. In particular, access to absorbents and disposal facilities including: 1) empty land to bury or burn the absorbent; 2) access to sanitary pads and incinerators within the community and/or school; and 3) access to places to dry the absorbent.

Lastly, the results of this study found significant variations between villages. This finding suggests that general interventions targeting MHHM and restrictions need to be created based on national goals using best practice programmes, and thereafter tailored to local context with members of the community.

Limitations of this study include limited results from the FGDs, validity and reliability of the restrictions scale, uncontrolled confounding, association, and generalizability. Although the adolescent girls were able to tell us the restrictions they faced in the FGDs, they were not able to articulate what actions they would take to overcome the restrictions. This means that adolescent girls do not think about the impact of restrictions on their daily life and have internalized the restriction. This limited the extent to which we could analyse the data. The validity and reliability of the restrictions scale was not assessed in this study, however the scale was piloted and pretested before. Uncontrolled confounding such as type of village (where GARIMA was implemented), knowledge, attitudes, self-efficacy, interpersonal communication, and social norms could cloud the true relationship between restrictions and MHHM and should be explored in future studies. Since this was a cross-sectional study, association could not be elicited. Future studies should conduct a longitudinal panel study to understand if there is an association between restrictions and MHHM. Lastly, since this data was only collected in rural areas among adolescent girls, generalizability might be limited to adolescent girls in rural India.

The objective of this study was to assess the relationship between restrictions and MHHM. In general, this study found that adolescent girls who reported not having to follow any restrictions reported higher levels of adequate MHHM. The distinction between personal and social restrictions was blurred in the minds of adolescent girls. There is a need to combat restrictions using multifaceted approaches by designing programmes that are context specific. Information about referral to medical and home-based remedies to reduce pain during menstruation is needed to reduce personal restrictions. Additionally, awareness and self-efficacy to defy social restrictions that may have been internalized is also needed. Lastly, access to clean absorbents and disposal facilities are needed to improve MHHM.

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