

Applying the Integrated Model of Menstrual Experience to Validate a Framework for Healthy Menstrual Experience for Young Girls in Pakistan through Structural Equation Modelling

Junaid-ur-Rehman Siddiqui^{*1}, Sharmeen Hussain², Nazo Pirzada¹, Hira Mustafa Khan¹, Umaimah Khan, Aisha Ijaz¹, Sana Tajuddin¹, Hannah-Kate Haynes³, Sheena Hadi¹

¹Aahung, Sasi Homes, G-18/6, Block 8, Clifton, Karachi, Pakistan

² St. Jude Children's Research Hospital, 262 Danny Thomas Place, Memphis, TN 38105, United States.

³Independent Consultant.

RESEARCH

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*Corresponding Author:

Junaid-ur-Rehman Siddiqui,
Aahung, Sasi Homes, G-18/6, Block 8, Clifton, Karachi,
Pakistan, E-mail: junaidrehman1994@hotmail.com

ABSTRACT

Research shows that young adolescent girls often do not receive the necessary information on menstruation, and the information they do receive is often late, incomplete, or inaccurate. The dearth of knowledge and prevalent misconceptions combined with the sociocultural taboo around menstruation lead to an overall negative experience for early adolescent girls at menarche and during the reproductive years to follow. This study adapted and contextualized the Integrated Model of Menstrual Experience to identify a parsimonious set of constructs that can be used to validate a framework for Healthy Menstrual Experience for young adolescent girls in Pakistan. Data were collected through a cross-sectional survey from October 2019 to December 2019 from 513 girls attending grades six

to eight in secondary schools from urban locality Karachi and rural locality Khairpur, province Sindh, Pakistan. 48 items were developed on the basis of the identified constructs from the adapted model and were subjected to factor analytic techniques for reduction and validation. The validated framework was composed of 15 items and five factors, with menstrual etiquette and norm (factor 1) as the distal antecedent heavily influencing girls' perception of safe menstrual knowledge (factor 2) and their accessibility to safe menstrual sanitation (factor 3). Knowledge and accessibility of safe menstrual sanitation are direct predictors of the core outcome, girls' menstrual experience (factor 4), which subsequently determines their social and school attendance (factor 5). The framework was validated through Structural Equation Modelling using a Diagonally-Weighted Least Squares (DWLS) estimation fitted to polychoric correlations and asymptotic covariances to account for the ordinal nature of the data. The validated framework charts a pathway for assessing girls' menstrual experience and its predictors, and subsequently, identifies points of intervention to ensure that young girls are able to have a healthy menstrual experience.

Key Words: Menstrual experience, integrated model of menstrual experience, structural equation modelling, school attendance, menstruation.

INTRODUCTION

Menstruation is a natural bodily function, unique to the female anatomy, experienced by girls upon reaching adolescence [1]. Despite being inherent to the anatomy, this



physiological phenomenon holds a wide array of sociocultural associations, specifically in low and middle income countries (LMICs), that transmogrify a girl's natural menstrual experience into an experience marred by negativity, anguish, and shame [2-7].

Integrated Model of Menstrual Experience

The Integrated Model of Menstrual Experience (IMME) (Figure 1) expands upon the critical antecedents of menstrual experience in extensive depth to inform the development of programme and policy frameworks, and interventions aimed at improving women's and girls' health and well-being [8]. The model was developed through systematic searching to identify qualitative studies of mostly adolescent girls' experiences of menstruation in low- and middle-income countries (LMICs). Based on 76 studies capturing experiences of over 6,000 participants from 35 countries, a directional model of menstrual experience was conceptualized (Text Box 1) [8].

Text Box 1: Description of the Integrated Model of Menstrual Experience

*"Through synthesis, we identified overarching themes and their relationships to develop a directional model of menstrual experience. This model maps **distal and proximal antecedents** of menstrual experience through to the impacts of this experience on health and well-being. The **sociocultural context**, including menstrual stigma and gender norms, **influenced experiences** by **limiting knowledge about menstruation**, limiting social support, and shaping internalised and externally enforced behavioural expectations. **Resource limitations** underlay inadequate **physical infrastructure** to support menstruation, as well as an **economic environment** restricting access to affordable menstrual materials. **Menstrual experience** included multiple themes: **menstrual practices, perceptions of practices and environments, confidence, shame and distress, and containment of bleeding and odour**. These components of **experience** were interlinked and **contributed to negative impacts** on women's and girls' lives. Impacts included harms to **physical and psychological health** as well as **education and social engagement**." (Hennegan et al., 2019)*

Menstrual Experience of Girls in Pakistan

Sociocultural context in Pakistan taboos menstruation as a bodily function, and the resulting menstrual stigma prohibits discussion on it as a subject while actively promoting myths and misconceptions around menstrual care that serve as the primary source of knowledge for girls and women [1, 9, 10]. Societal beliefs, synonymising menstruation with impurity and menstrual care with secrecy, have persistently imposed behavioural restrictions that limit the autonomy of adolescent girls [4]. Restrictive beliefs that prohibit showering during menstruation, expression of pain, and conversation around men, and dictate hiding of the menstrual status from men by tolerating pain and continued engagement in household chores while "managing" menstrual hygiene in secrecy, are cemented as practices that form the menstrual etiquette and norm in Pakistan [11-13, 10, 14]. This norm is accepted and celebrated by the patriarchal social system that commodifies a girl's fertility, but is simultaneously appalled by the "impure"¹ girl and "impurity" as the signs of fertility itself [12]. Furthermore, in the absence of systems and sources for accurate menstrual knowledge, the onus is put on women to guard the secrecy and further the silence and taboo by passing on these beliefs and practices inter-generationally with limited room for question and discussion [15]. Young girls compelled to feel shame, embarrassment, and distress for their newly-changing bodies and for menstruating itself, conditioning them into internalizing a sense of revulsion towards their bodies [6]. The negative psychological impact from the subsequent cultural, social, familial, and parental reinforcement results in a girl's unique menstrual experience marred and her formative body image, her self-esteem, her youthfulness, and her individuality suffocated for merely becoming an adolescent [16]. Additionally, there is very little awareness

¹ Traditional interpretations of Abrahamic religious texts perceive women to be unclean or impure while menstruating and whoever touches her would be unclean until the evening and if a man has sexual relations with a menstruating woman, he will be perceived as unclean for seven days. Hence, if a man has sexual relations with a menstruating woman, he is not perceived as unclean only until evening, but for seven days. When seven days pass from the beginning of menstruation, the woman is regarded as clean and thus sexual contact is permitted [12, 17].

and recognition of health problems related to menstruation, such as pre-menstrual dysphoric disorders and amenorrhea, which further restricts girls from even sharing their experiences of menstruation as it is too “different” from their peers and the norm [18].

The paradoxical nature of a society valuing and preserving fertility while hiding the signs of fertility and persecuting the fertile is perhaps best reflected through young girls aged 12 to 15 associating menarche with sadness and an imposition of “adulthood” while receiving minimal communication about their changing bodies and its significance, and greater communication around their normatively-upgraded social functionality as a “woman” [14]. As dictated by the gender and menstrual norm, young girls vicariously learn the intergenerational regiment of acting “normally” by using the traditional doctrine of remedies for pre-menstrual and menstrual pain while ensuring continued participation in household chores and caring for their menstrual hygiene frequently and in utter secrecy [4, 14]. The fundamental principle behind this is to ensure that the entirety of the menstrual experience from pain, its “management” or care, its sanitary materials, and its existence is completely hidden away from men [9, 13, 4]. Failing to uphold these standards of secrecy is viewed as a breach in menstrual etiquette and norm indicative of socially-undesirable feminine standards [13].

World Health Organization defines menstrual hygiene “management” (MHM) as, “Women and adolescent girls using a clean menstrual “management” material to absorb or collect menstrual blood, that can be changed in privacy, as often as necessary for the duration of a menstrual period, using soap and water for washing the body as required, and having access to facilities to dispose of used menstrual “management” materials [5]. However, across socioeconomic classes, access to fundamental physical infrastructure and economic resources for safe menstrual sanitation is not extended to an adolescent girl, which makes them resort to doing the bare-minimum in both school and home [12, 19, 15]. Access to fundamental economic resources i.e., safe and clean materials such as a basic sanitary pad or a washable cloth is alarmingly low,

even in the metropolitan and middle-class communities of Karachi, Pakistan, only 20% adolescent girls used sanitary pads with around 61% using an old piece of cloth to absorb period blood [1]. While using a cloth itself is not necessarily a bad practice, it often becomes unhygienic due to the “necessity” of maintaining secrecy with limited accessibility and availability of open spaces to dry it for reuse [20]. Furthermore, only 56% girls in Pakistan have access to fundamental physical infrastructure i.e., a safe and private sanitation space with clean water, a soap, and a dustbin, with the remaining 44% girls not having access to resources for supporting their menstrual hygiene in their homes, schools, and workplaces [9]. Poor access to fundamental menstrual sanitation, along with the behavioural expectations, exposes young girls to completely avoidable physiological harm while becoming a major source of psychological distress and adolescent depression [21, 22]. Moreover, limited access coupled with the sociocultural menstrual stigma further hampers young girls in their daily functioning by forcing them to be absent from school and social gatherings during their menstrual periods [9, 20]. Conclusively, the structural and systematic absence and negligence of space, time, and resources to maintain menstrual hygiene normatively with frequency, secrecy, and privacy further isolates young girls from the leftovers of social and schooling opportunities they could access as a privilege, and not a right.

Contextual Adaptation of the IMME

Tampon or pink tax, which classifies menstrual sanitation through napkins and pads as a luxury, is levied upon feminine hygiene products by the government as the cost of managing an “impure” bodily function [23-25, 7]. Akin to the pink tax which surmises the additional monetary cost for menstruating, there is the sociocultural “girl tax” system which underscores the commodification of fertility and the human cost for menstruating (Text Box 2) [23, 26, 27, 7]. The study has adapting and contextualized the Integrated Model of Menstrual Experience by conceptualizing psychosocial constructs and causal pathways reflective of adolescent girls’ menstrual

experience in Pakistan's sociocultural "girl" tax system (Figure 2).

Text Box 2: Sociocultural "Girl" Tax System

The sociocultural tax of being born a girl in Pakistan is first levied at birth by disassociating her from the "family name" and assigning the name of the socially-appointed "protector" and patriarch of her prospective fertility (Krolokke et al., 2012; Lodhi & Siddiqui, 2014). Depending upon the demography and the geography, the girl will be afforded limited "play" with regimental training from childhood in household chores in behaviour, expected as her sociocultural tax for being born a girl and the beginning of the sociocultural suffocation of her identity and voice (Khan, 2008; Purewal & Hashmi, 2015; Siddiqui, Khan, et al., 2021).

The next layer of the "girl tax" is levied at the onset of menarche as the proof of her socially-commodifiable fertility and viability for social commodification, the early adolescent girl is permanently stripped of individual and social liberties that she was afforded as privileges, and not rights (Ibitoye et al., 2017; Jeffery, 1989; Sharp, 2000). This serves to cause the elimination of choice and silent obedience in acceptance of restrictions imposed upon her body in the form of added clothing, and reduced mobility and socialization, paying the sociocultural tax of her birth, to her appointed patriarch by burdening herself with his "honour" (Jeffery, 1989; Lodhi & Siddiqui, 2014). This serves as her acknowledgement of his burden of "protecting and preserving" her fertility until it is traded to another patriarch, and the beginning of the sociocultural suffocation of her adolescent mind and body (Jeffery, 1989; Krolokke et al., 2012; Lodhi & Siddiqui, 2014; Sharp, 2000).

*With guidance provided predominantly on social functioning and masking around her menstrual experience, the adolescent girl is expected to learn vicariously to **preserve and maintain her socially-commodifiable fertility by upholding the menstrual etiquette and norm of silence, tolerance, secrecy, and invisibility** (Hamid et al., 2010; Hegland, 1998; Ibitoye et al., 2017). With the burden of hiding "impurity" imposed as the next sociocultural tax of menstruating along with the burdens of hiding her "body" as well as her "identity and voice", the adolescent girl cannot access the soap, water, cloth, and private space to manage the natural phenomenon that socially deprived her of existence (Crichton et al., 2013; Garg & Anand, 2015; Hegland, 1998; Hennegan, 2017). Thereby, exposing herself to preventable physiological and physical harm predisposing her reproductive parts, critical in the socially-commodifiable fertility, to internal or external infections (George, 2013; Rizvi & Ali, 2016).*

*This holistic system of sociocultural tax suffocating a girl's identity, individuality, voice, body, mind, health, spirit, and fertility as the cost of her menstrual experience, that she still has to manage without compromising the socially-desirable **feminine standards of masking femininity** through the menstrual etiquette and norm of silence, tolerance, secrecy, and invisibility for ensuring that she remains masked, oblivious, revolted, and unaware of her own "sexuality" (Bashir et al., 2017; Duesterhaus et al., 2011; Hegland, 1998; Hennegan, 2017; Ibitoye et al., 2017; Jeffery, 1989; Krolokke et al., 2012). This aspect of her existence that isn't part of the systematic sociocultural suffocation as its non-existence is the goal of the system is the hidden cost of every sociocultural tax levied upon her with her death, in extreme cases, as the payment of her daring to realize and explore her **systematically "non-existent" adolescent sexuality** (Bashir et al., 2017; Jeffery, 1989; Lodhi & Siddiqui, 2014; Schooler et al., 2005).*

Challenges in Cross-cultural Application and Measurement

Usage of ecological and behavioural theory cross-culturally presents substantial challenge/es in application,

Text Box 3: Application of SEM in Social Sciences

"SEM provides a much better formal way not only to verify a given theory but also to conduct this verification on the basis of the analysed measures, and because they join and at the same time confront the two spaces, i.e., theory and empirical data, they offer researchers a huge potential in the scientific explanation of phenomena alongside simple descriptive statistics or simple empirical relationships. The application of SEM analysis in the social sciences permits their development, because SEM, more effectively than ever, confronts the "theory" with "experience", which results not only in optimizations of theoretical models but also leads to the optimization of tools used for the diagnosis of reality. It is the very complex structure of social phenomena that creates a growing demand for the use of SEM models, which are supposed to "copy" the social phenomena precisely. In other words, the researcher, when beginning to construct theoretical models which aspire to explain complex scientific problems of a social character, is, thanks to empirical verification, capable of gaining a better understanding of the importance of the examined phenomena. However, before the construction process of SEM models starts, the researcher should remember to maintain all theoretical assumptions in the SEM analysis. The aim of the model construction is as simple an 'explanation' of the examined phenomena as possible, whereas the model itself should be coherent with the empirical observations." (Tarka, 2018).

measurement, and validation [28]. In the study's context, the initial challenge is to ensure culturally-congruent selection and translation of the multidimensional concepts described by the IMME [29, 30]. In the backdrop of Pakistan's unique menstrual culture, specific psychosocial constructs, from the IMME, would have to be extrapolated and conceptualized to depict the context and capture girls' menstrual experiences [31]. Existing literature, outside of Pakistan, on cross-cultural research highlights that adaptation of a theoretical model and measuring the psychosocial constructs therein is predisposed to systematic measurement error [32, 33, 28, 30]. Relative to mathematicised theorems and empiricism employed in application, theories in social sciences are often characterized as "vague, imprecise, and highly relative" applied and tested through psychometrics without due

statistical rigor [34-37]. Likert-type agreement/disagreement scales, commonly deployed for psychometric assessments across cultures, produce high measurement error due to the subjective nature of the items and differences in cross-cultural interpretations and implementations of the questionnaire [38, 39]. This is further exacerbated by the usage of continuous and composite measures for “latent” psychosocial constructs, and using estimation methodologies also unsuitable for ordinal psychometric items [34, 35, 37].

Latent Variable Modelling

Latent variable modelling or structural equation modelling (SEM) is a complex multivariate analysis that combines factor analysis with path analysis, and omits measurement error by using latent factors for psychosocial constructs and estimating all direct and indirect effects on specified causal relationships [40, 41, 37]. SEM can undertake complex, multidimensional, and precise analysis of empirical data taking into account “different aspects of the examined reality and abstract concepts or theoretical constructs” (Text box 3) [37]. This allows SEM to compute complex hierarchical or non-hierarchical and recursive or non-recursive structural equations, and attest to the validity of simplistic and comprehensive models [40, 42].

SEM has been sparsely used in behavioural and perceptual assessments of menstrual health. Dishman [43] used SEM to study the impact of self-efficacy in mediating positive menstrual hygiene behaviours with a control group and sampled, cumulatively, 2,086 adolescent high school girls in the United States. Further in SEM and Menstruation research, Joinson et al. [44] sampled 2,184 adolescent girls in the United Kingdom to showcase the association between on-set of menarche and depression. In a similar study, Slater and Tiggerman [45] applied structural equation modelling to predict self-objectification among 141 adolescent girls in Australia by using the on-set of menarche and sport participation as the predictors. Recently, Chew et al. [46] used the latent variable approach to psychometrically demonstrate the impact of sociocultural and religious norm on menstrual perceptions and behaviours amongst

university girls in Malaysia. To the best of our knowledge, very few studies have used latent variable modelling, embedded with psychometrics and ordinal methodologies in Pakistan [47-49], and there have not been any studies utilizing these in the context of menstrual perceptions and behaviours.

Study Aim

The dearth of literature on using systematic frameworks for informing interventions on menstrual health vis-à-vis the absence of rigorous methodologies in measuring psychosocial constructs determining menstrual experience underpins the significant gap in menstrual research and programs in Pakistan. This lack of research on conceptualizing, measuring, or validating social and behavioural change models has led to ineffective programming which fails to account for the complex dynamics of menstruation for adolescent girls. In light of this and to attempt to bridge this gap, this study aims to validate a framework identifying determinants of healthy menstrual experience for post-menarche adolescent girls in Pakistan through latent variable modelling. This was achieved by adapting and contextualizing the Integrated Model of Menstrual Experience through conceptualization of psychosocial constructs and causal pathways reflective of adolescent girls’ menstrual experience in Pakistan (Figure 2) [8]. Subsequently, the constructs’ validity will be assessed using factor analysis, and the hypothesized framework (Figure will be tested and validated through SEM [46, 43-45]. The study will test for theoretical sufficiency by exploring whether the constructs theorized by IMME emerge in the study’s context, and whether the relationships specified by IMME to explain menstrual experience hold for adolescent girls in Pakistan [50].

Methods

Study Design

A psychometric assessment was conducted to understand early adolescent school girls’ perceptions and experiences of menstruation in province Sindh, Pakistan.

The psychometric assessment was operationalized through the distal and proximal antecedents of menstrual experience and menstrual impact identified in the Integrated Model of Menstrual Experience [13]. This assessment served as the baseline assessment for a two-arm quasi-experimental evaluation of a school-based comprehensive sexuality education (CSE) programme. The evaluation was designed to assess the impact of Aahung CSE's menstrual health and hygiene module on school-going early adolescent girls' perceptions and experiences of menstruation in both rural and urban localities [14]. Karachi, the urban locality, is the largest urban center across Pakistan, while Khairpur, the rural locality, has one of the largest rural populations in Sindh province, making them ideal settings for the study [1].

Study Instrument and Framework

The study adapted the Integrated Model of Menstrual Experience by reviewing the model in the study's context to identify and transform themes and sub-themes into latent psychosocial constructs. These latent constructs and their causal relationships hypothesize a Framework for Healthy Menstrual Experience (Figure 3) to identify facets and beliefs that leads to a young girl having a healthy menstrual experience within the aforementioned sociocultural "girl tax" system [23, 5]. The latent constructs were operationalized through a pool of psychometric items in the study instrument that represented specific beliefs representing each construct in the native language. The psychosocial constructs employed are described below under the three contextualized meta-themes of Sociocultural "Girl" Tax System (Distal Antecedent), Safe Menstrual Knowledge and Sanitation (Proximal Antecedent), and Healthy Menstrual Experience (Experience and Impacts).

Meta-theme: Sociocultural "Girl" Tax System

Based on the extreme societal stigmatization of menstruation along with gender inequality in socioeconomic and cultural norm and resources, Menstrual

Etiquette and Norm (distal antecedent) was theorized as the foundation of the Sociocultural "Girl" Tax to be levied upon each at the onset of menarche [9].

Latent construct Negative Menstrual Etiquette and Norm with 07 psychometric items, captured young girls' perception of societal menstrual stigma, restrictive gender norm, and behavioural expectations associated with menarche.

Meta-theme: Safe Menstrual Knowledge and Sanitation

The pervasive impact of Negative Menstrual Etiquette and Norm is hypothesized to trickle-down to young girls through the social support system passing on axiomatic and filterable Perceived Menstrual Safe Knowledge (proximal antecedent) while affording them the bare-minimum Access to Safe Menstrual Sanitation (proximal antecedent) [13, 19, 15].

Latent construct Perceived Safe Menstrual Knowledge with 10 psychometric items, assessed young girls' knowledge of adolescence along with their beliefs around menstrual health and hygiene practices.

Latent construct Access to Safe Menstrual Sanitation with 15 psychometric items, assessed young girls' access to physical sanitation spaces in home and school with clean water, soap, and washing and disposal facilities along with their access to the menstrual material of their choice.

Meta-theme: Healthy Menstrual Experience

Upon reaching menarche, the Experiential Cost of Menstruation is cut in half by the young girl having a Positive Menstrual Experience hypothesized to be directly determined by the adoption of the filtered axiomatic Perceived Safe Menstrual Knowledge and bare-minimum Access to Safe Menstrual Sanitation [13, 8, 5].

Latent construct Positive Menstrual Experience with 14 psychometric items, assessed young girls' perception of their personal and social menstrual agency along with their adopted shame, behaviours, and practices for health and hygiene during menstruation.

The second half of the Experiential Cost of Menstruation, Social and School Withdrawal, is hypothesized to be conditionally determined and easily averted by a Healthy Menstrual Experience resulting in continued Social and School Attendance [9, 8].

Latent construct Positive Social and School Attendance with 02 behavioural outcomes that assess girls' participation in social gatherings and attendance in school during menstruation.

Pilot-testing of Study Instrument

The 48-item psychometric scale operationalized through a five-point Likert scale was developed in English, and subsequently translated into Urdu and Sindhi, and back-translated for accuracy. Girls' menstrual status was assessed by asking if they had begun to menstruate, and if the girl answered 'yes'. In a review of the measurement of pubertal development, it was reported that self-reports of onset of menarche are reliable and valid [51, 52].

Prior to the survey, the study instrument was tested amongst school teachers and a small sample of students. Firstly, the teachers were asked to review the items included in the survey for comprehensibility and acceptability, and their feedback was incorporated into the items. Following this, the instrument was piloted with sixth, seventh, and eighth grade girls from the ten schools to gauge their understanding of the language and their comfort with responding to the items, and based on their feedback, minor changes were made to the items. Moreover, pilot-testing was conducted in schools that were not enrolled in the study, but shared sociodemographic and geographic characteristics with the schools in the study.

Sampling and Data Collection

Lead implementing organization, Aahung (a Karachi-based NGO), partnered with secondary schools from Khairpur and Karachi to implement and evaluate the menstrual health and hygiene module for girls attending grades six to eight [14, 53]. Prior to data collection, circulars containing a description of the research study and a

parental consent form was circulated amongst the parents through girls attending grades six to eight. Each school management was asked to share a list of 45 girls, 15 from each grade, whose parents had provided written informed consent to their daughters' participation in the study. Data were collected from 513 girls through a paper-based, cross-sectional survey from October 2019 to December 2019. All participating girls provided written informed assent prior to participation.

Statistical Analysis

All analyses were performed using LISREL Version 10.0 Jöreskog, K.G. & Sörbom, D. (2006). LISREL 10.3 for Windows [Computer software]. Lincolnwood, IL: Scientific Software International, Inc. and Stata MP Version 16.0 (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LP).

Overall sample characteristics were used for observing the sociodemographic characteristics. Composite variables were generated for each construct containing the average participant score on that construct. On the five-point scale, an average score > 3.5 was categorized as "Unfavorable or Low", an average score > 3.49 & < 4.5 was categorized as "Conservative or Moderate", and an average score > 4.49 was categorized as "Favourable or High" [54].

69% study participants (n= 299) had reached menarche, and were separated from the dataset for framework validation through Structural Equation Modelling (SEM) [41]. 37 observations were further deleted using listwise deletion because of missing values giving a sample size of 262 participants who had reached menarche. SEM using Diagonally Weighted Least Squares (DWLS) estimation fitted to polychoric correlations and asymptotic covariances was used for all model estimations [49, 35]. Owing to the large item-pools for each scale, separate one-factor measurement models were estimated, using Confirmatory Factor Analysis (CFA), to extract three/four-item parsimonious scales for each factor by retaining the three items with the highest standardized loadings [54, 55]. After item reduction, a 14-item measurement model for measurement validity, and final hypothesized causal model

were estimated [56, 35]. Satorra-Bentler (SB) χ^2 , Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA) were used to test the fit of measurement and hierarchical models [41]. Internal consistency of the model was assessed using Composite Reliability, Coefficient H, Ordinal Alpha and McDonald's Omega [57, 56]; estimates were obtained using standardized factor loadings through polychoric correlations, accounting for the ordinal nature of the items [34, 49].

Ethical Consideration

The study protocol was approved by the National Bioethics Committee (NBC) Pakistan (Ref: No. 4-87/NBC-407/19/104). Parental consent was obtained for all survey participants before data collection since all participants were below the age of 18 while the participants themselves provided written informed assent.

Results and Discussion

Sociodemographic Assessment

The characteristics of the study participants are described in the table below. All participants were secondary school girls with a mean age of 13, and 63% girls had reached menarche. Participants were split proportionally in three grades with 35% girls attending the 6th grade, 30% girls attending the 7th grade, and 34% girls attending the 8th grade. Moreover, 61 percent participants belonged to the rural locality with 43% participants living in a joint family system.

Psychometric Assessment

Antecedents: 93% of the participants experienced a negative menstrual etiquette and norm with no participant experiencing positive etiquette and norm underscoring the ubiquitous nature of the menstrual stigma described above. With regards to menstrual knowledge and access to sanitation, 60% participants had moderate knowledge of

safe menstrual practices and 62% participants had access to basic sanitation resources for menstrual sanitation.

Menstrual Experience: 43% participants reported using unsafe menstrual practices while 52% reported using moderately safe menstrual practices with only four percent participants reported using the WHO-recommended safe practices. Aligned with these results, only four percent girls reported having high personal and social menstrual agency with majority (69%) reported having low agency for making decisions for their menstrual care and health.

Menstruation Impact: Only 10% percent girls reported their school attendance being heavily affected by menstruation with the remaining 90% able to maintain average or high school attendance while they are menstruating. Moreover, a similar pattern was observed for social participation as well, however, a greater proportion (29%) of the participants reported their social participation getting reduced due to menstruation with the rest of the participants able to maintain average or high social participation.

Structural Equation Modelling

Measurement Validation through CFA

Based on the criteria specified and four one-factor measurement model estimations, 48 items were reduced to 24 items. The final five-factor 15-item measurement model estimated and yielded a good fit [SB χ^2 (40, 262) = 159.61 ($p < 0.05$), CFI = 0.95, SRMR = 0.08, RMSEA = 0.06]. Standardized loadings from the second measurement model were used to extract the reliability estimates [34]. Coefficient H for all constructs was greater than 0.8, and Composite Reliability, Ordinal Alpha, and Ordinal Omega for all constructs were greater than 0.6. Furthermore, inter-item polychoric correlation estimates established convergent and discriminant validity [54]. Latent constructs in the model were highly correlated to each other which provided credence to the theorized framework.

Framework Validation

To validate the theorized framework, the hypothesized model was tested with the specified causal pathways. The model was a good fit [SB χ^2 (85, 262) = 163.49 ($p < 0.05$), CFI = 0.95, SRMR = 0.08, RMSEA = 0.06] (Figure 4). Structural paths demonstrated that a unit increase in the score for Negative Menstrual Etiquette and Norm reduces the score for Perceived Safe Menstrual Knowledge by 105% ($\beta = -1.051$, Std. Err. = 0.098, t -value = -10.680) and Access to Safe Menstrual Sanitation by 74% ($\beta = -0.740$, Std. Err. = 0.119, t -value = -6.209), respectively. Subsequently, a unit increase in the score for Perceived Safe Menstrual Knowledge improves the score for Positive Menstrual Experience by 53% ($\beta = 0.526$, Std. Err. = 0.167, t -value = 3.147), and a unit increase in the score for Access to Safe Menstrual Sanitation improves the score for Positive Menstrual Experience by 40% ($\beta = 0.400$, Std. Err. = 0.175, t -value = 2.287). Subsequently, a unit increase in the score for Positive Menstrual Experience improves the score for Positive Social and Educational Attendance by 63% ($\beta = 0.625$, Std. Err. = 0.104, t -value = 5.979). Overall, the model explained 76% of the variance in Positive Menstrual Experience ($R^2 = 0.764$) and 39% of the variance in Positive Social and Educational Attendance ($R^2 = 0.390$).

This reported goodness of fit indices confirms that the theorized model for a healthy menstrual experience fits the data. This further validates the study's framework and confirms theoretical sufficiency, as demonstrated by the high proportions of variance explained in the outcome variables.

Discussion

This study is able to provide the first definitive layer of evidence for the causal relationships between the constructs in the Integrated Model of Menstrual Experience by adapting the model to the local context and extracting a parsimonious set of constructs for measurement and validation. Several studies have linked and demonstrated the causal effect of menstrual stigma on girls' perceived knowledge and accessibility [1, 58, 21, 8, 19, 10, 5], and the

causal effect of negative menstrual experiences on social and school withdrawal [23, 16, 58, 16, 22, 3]. This study demonstrates the complete causal effect of the distal antecedent menstrual etiquette and norm on perceived menstrual knowledge and accessibility which determines their overall menstrual experience vis-à-vis their social and school attendance. The positive and simplistic framing of constructs allowed us to delineate the impact of pervasive menstrual stigma and expand upon the impact of perceived safe knowledge and accessibility to safe sanitation spaces. In essence, the stigma dictates secrecy, privacy, and frequency, and severely affects girls' social functioning and psychological health [8]. However, strictly within the context of menstruation as an anatomical bodily function, they are, conditionally, able to circumvent it to have a healthy menstrual experience resulting in retention of their social and school attendance [59, 5]. The conditionality being their awareness of the core facets of safe menstrual knowledge (maintaining hygiene and using/changing menstrual materials) and their accessibility to basic safe menstrual sanitation at home (privacy, soap and water, space to shower, and space to change materials) [23, 59, 5]. *Citrus paribus*, the bodily pain and distress caused by a bodily function requires maintenance of bodily hygiene in a safe and private space with water, soap, and an absorbent piece of cloth.

This study presents a model for healthy menstrual experience for adolescent girls in rural and urban districts of province Sindh in Pakistan. Behaviour change models are often critiqued for being "western-oriented" and not applicable to eastern cultures [30]. These cultural differences are accounted for by the study's contextual adaptation of IMME, and its subsequent measurement and validation for Pakistan's setting. The study used psychometric scales comprising items structured as conversational queries in Urdu and Sindhi, main national and provincial languages, respectively, in Pakistan. Given the semantic similarities between Urdu and the other major regional languages, the questions/items can easily be adapted to these languages a-priori.



While the evidence presented in this study is certainly encouraging, the model should be tested with older girls and girls from different demographics, and in its current form, it can be applied in community- and school-based research and interventions to assess young girls' menstrual experience, and their perceptions of menstrual stigma and safe menstrual knowledge, and their accessibility to sanitation resources. Furthermore, the framework can be applied to design and evaluate school- and community-based programmes aimed at improving young girls' menstrual experience. This will be critical in developing tailored interventions to ensure that adolescent girls have knowledge and access to the fundamentals of having a safe and healthy menstrual experience.

Conclusion

Menstruation serves as the core marker of suppression of girls' individuality, sexuality, rights, and voice, and despite the system determining a girl's worth based on her fertility, she is left to be unaware of the physical mechanics of her body and the value of menstruation. Young girls, specifically, at the cusp of menarche or right after, are specifically vulnerable to the detrimental impact the prevailing menstrual stigma and norm can cause, however, it can be curtailed at a physiological level by providing them with bare-minimum resources and spaces. This apparently minimal provision allows them to have a healthy menstrual experience resulting in retention of individual and social functioning.

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PEER REVIEW

Not commissioned. Externally peer reviewed.

TABLES

Table 1: Sociodemographic Assessment of Study Participants

Characteristic	Percentage (n) or Mean (SD)
Age	12.88 (1.62)
Locality	
Urban	38.58% (196)
Rural	61.42% (312)
Grade	
Sixth grade	35.31% (179)
Seventh grade	30.37% (154)
Eighth grade	34.32% (174)
Reached Menarche	
Yes	63.35% (299)
No	36.65% (173)
Family System	
Joint	43.40% (207)
Nuclear	56.60% (270)

Table 2: Psychometric Assessment of Study Participants.

Meta-themes and Constructs	Mean (SD)	Low/ Negative	Average/ Moderate	High/ Positive
	Scale (1-5)	Frequency (n)		
Antecedents				
Menstrual Etiquette and Norm	2.59 (0.60)	93.39% (311)	6.61% (22)	00.00% (00)
Access to Menstrual Sanitation Resources	3.76 (0.47)	28.53% (95)	62.46% (208)	09.01% (30)
Perceived Menstruation Knowledge	3.56 (0.49)	34.73% (116)	60.18% (201)	05.09% (17)
Menstrual Experience				
Safe Menstrual Practices	3.51 (0.51)	43.54% (145)	52.25% (174)	04.20% (14)
Personal and Social Menstrual Agency	3.26 (0.65)	68.86% (230)	27.54% (92)	03.59% (12)
Menstruation Impact				
School Attendance	4.01 (0.92)	09.97% (29)	62.54% (182)	27.49% (80)
Social Participation	3.32 (1.16)	28.81% (85)	57.62% (170)	13.56% (40)

FIGURES

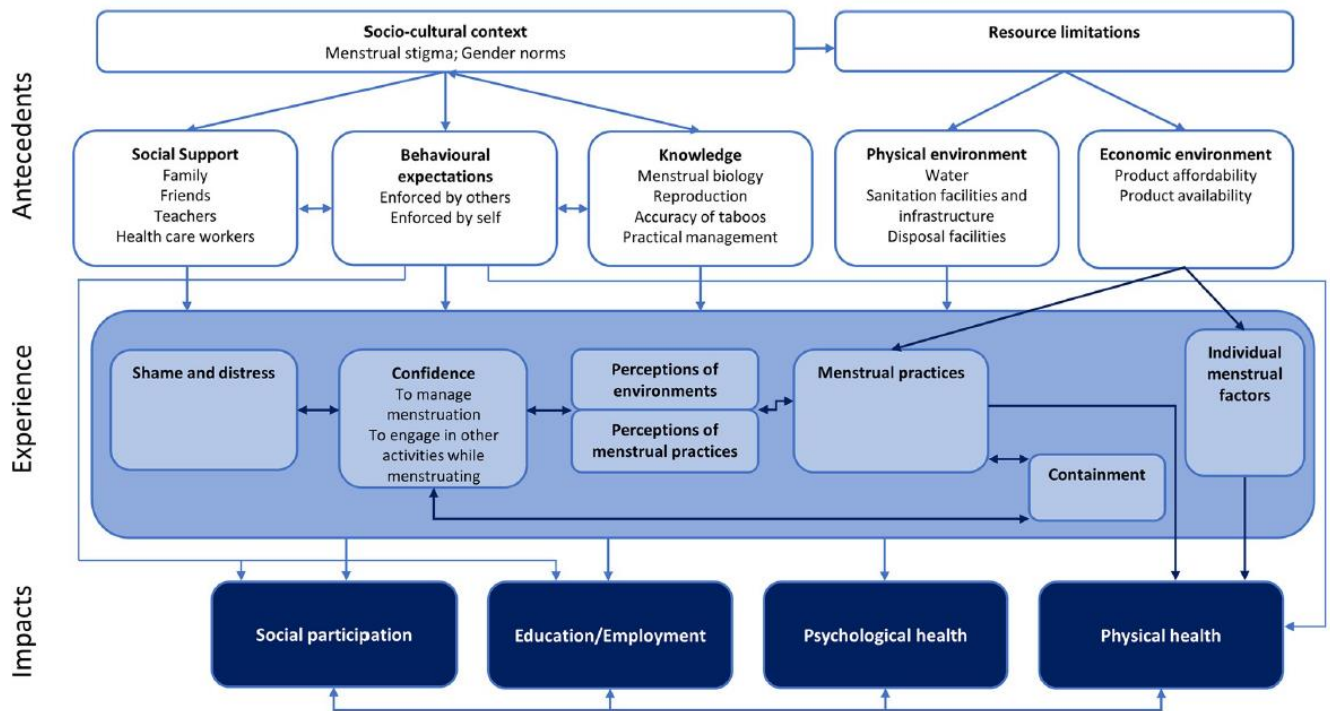


Figure 1: Integrated Model of Menstrual Experience (Hennegan et al., 2019).

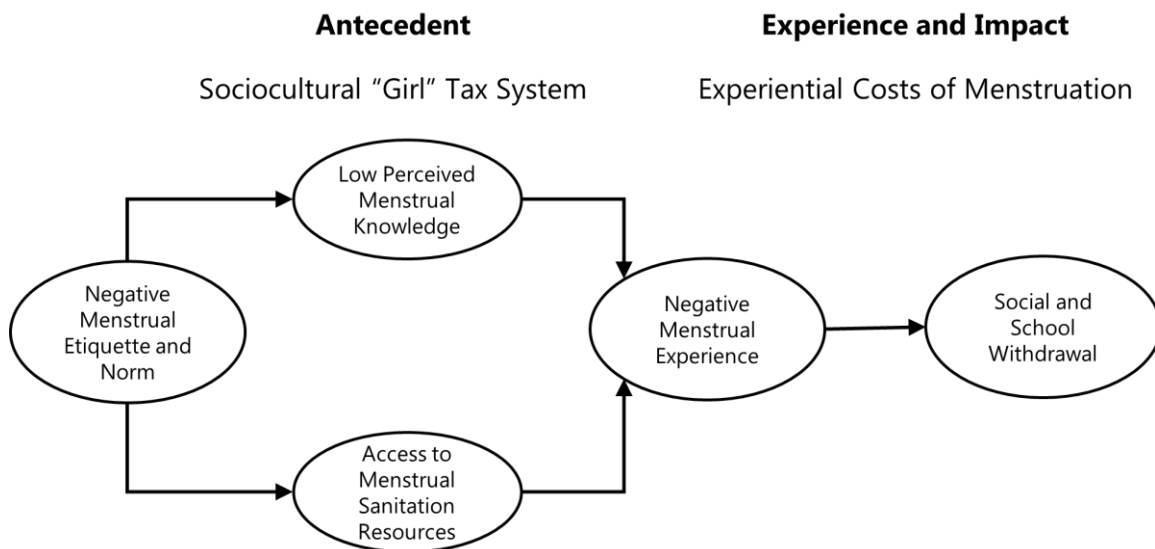


Figure 2: Contextual Adaptation of the Integrated Model of Menstrual Experience.

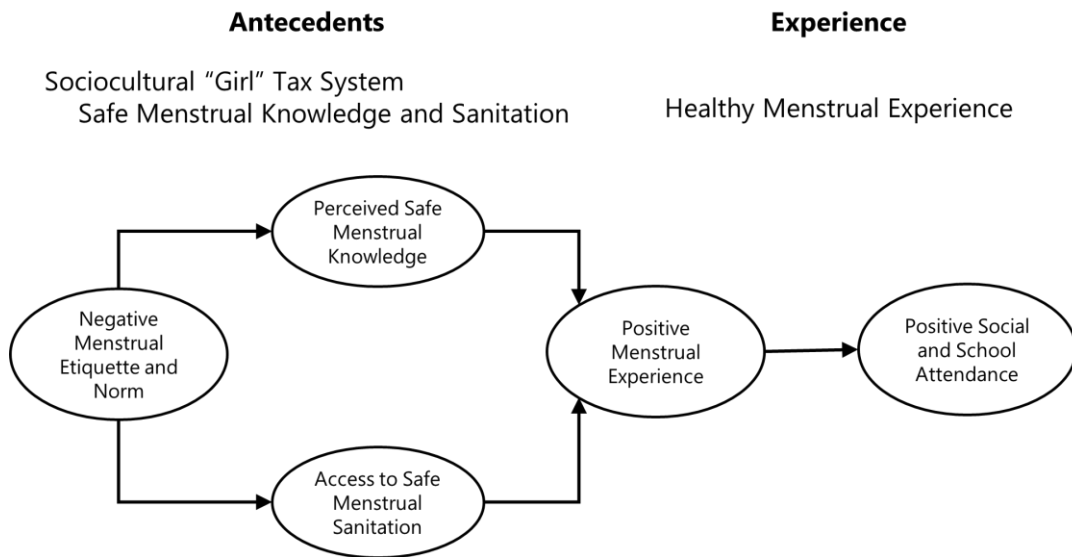
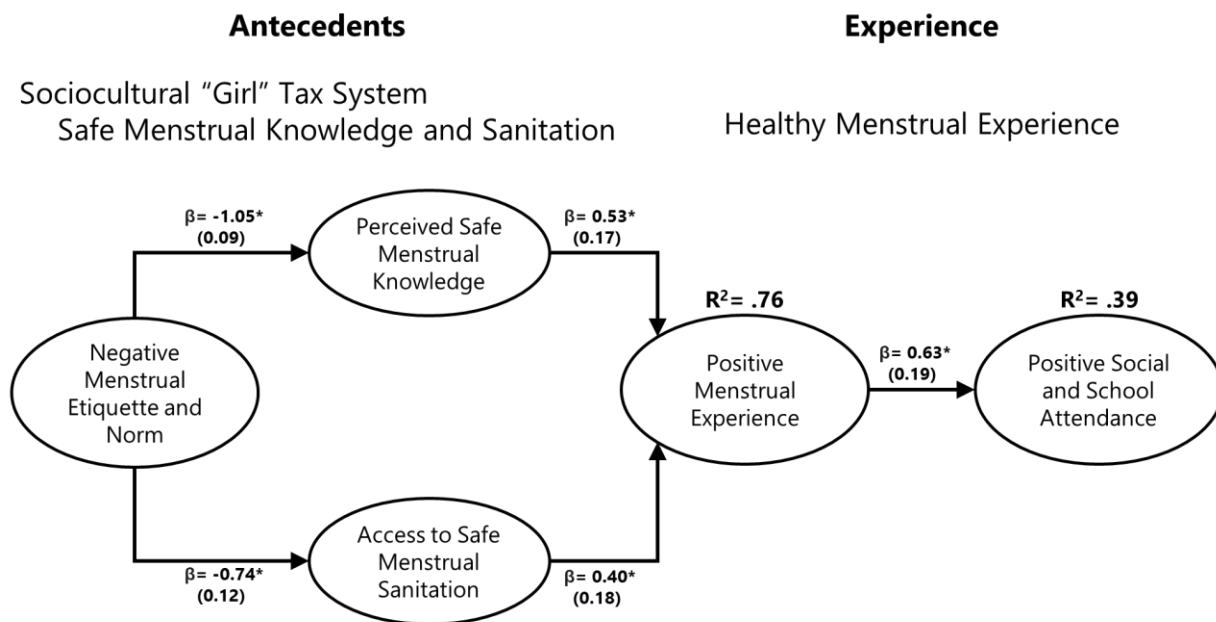


Figure 3: Hypothesized Framework for Healthy Menstrual Experience.



Model Goodness of Fit Statistics: SB χ^2 (85, 262) = 163.49 ($p > 0.05$), RMSEA = 0.06, CFI = 0.95, SRMR = 0.08

Figure 4: SEM Estimation of the Framework.