

Research Paper

Menstrual waste behaviour of young adolescents: a theory of planned behaviour approach

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ABSTRACT

There is a significant rise in the pile of non-biodegradable menstrual waste. Still, the majority of the studies focused on the variety and quality of menstrual products, and only a few investigated the sustainable and safe disposal of used menstrual material. The theory of planned behaviour serves as the foundation upon which the paper constructs its theoretical framework to study menstrual waste disposal behaviour among adolescents. It finds that a variety of social contexts and circumstances influence adolescents' intentions to dispose of used menstrual products carelessly, indirectly contributing to environmental degradation. This paper is an attempt to examine the existing gap in the literature and understand the attitudes and intentions that underlie such an activity. This paper also suggests ways for policymakers and implementors to influence the behaviour of adolescents resulting in hygienic and environmentally safe disposal of menstrual waste.

Key words: adolescents, menstruation hygiene management, theory of planned behaviour, waste disposal and behaviour

HIGHLIGHTS

- The rise in menstrual waste and sustainable ways to deal with them has become a pressing issue.
- The issue of menstrual waste disposal is ignored by policymakers and implementers.
- The theory of planned behaviour is utilised for the first time to identify factors causing improper menstrual product disposal.
- Identified factors can be influenced to steer adolescents towards environmentally safe disposal of menstrual waste.

INTRODUCTION

Menstruation is a distinctive biological phenomenon unique to women, adolescent girls, transgender, and non-binary individuals who menstruate (IWMs) (Babbar *et al.* 2023). They start menstruating between 11 and 14 years and continue till menopause at 51 years of age (U.S. National Library of Medicine 2017). In some cases, females may attain menarche at the age of 7 years (Prince *et al.* 2023) and early menopause between the ages of 40 and 44 years (Mishra *et al.* 2024). To smoothen the duration of menstruation, increasingly IWMs are using pads or tampons with the current menstrual waste burden reaching 12 billion pads per year only in India. Furthermore, a single disposable pad (made of super absorbent hydrogel, a synthetic polymer) (Ahmed 2015) takes 500–800 years to decay, which worsens the problem of menstruation waste management (Muralidharan 2018). Even today, only disposable sanitary pads are aggressively promoted. Sustainable alternatives, like reusable cloth pads, menstrual underwear and cups, are overlooked by both the government and the market making the alternatives comparatively less affordable and accessible (Babbar & Garikipati 2023).

Without effective menstruation waste management systems, most IWMs throw used products in toilets or garbage bins. Insufficient waste collection and disposal facilities and growing heaps of non-biodegradable waste create health and environmental problems. Thus, the management of menstrual waste becomes a pressing issue.

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Challenges of menstrual waste disposal (MWD) include their impact on sewerage systems (Sommer *et al.* 2013), delayed degradation of menstrual products (Bridle & Kirkpatrick 2005), and lack of legislation and procedures to address this waste (Elledge *et al.* 2018). MWD has also been ignored in low- and middle-income countries (Scorgie *et al.* 2015; Garikipati & Boudot 2017).

Similarly, popular literature (Table 1) also overlooked MWD behaviour and the attitudes that create it, focusing only on the health of IWM during periods, hygiene needs and facilities for the management of monthly periods.

Since menstruation is associated with sexuality and reproduction and is seen as a female's issue to be addressed only by them and others who menstruate, non-menstruators are unwilling, uncomfortable or uninterested in discussing it (Van Eijk *et al.* 2016). IWM are left to deal with menstruation on their own without any support from non-menstruators. Furthermore, menarche scares and worries several adolescents because they are unprepared. Their main sources of information are mothers, other female relatives and female peers, although this information is often inadequate and untimely (Hennegan *et al.* 2019).

Unfortunately, the literature devoted to MWD is very limited. Some has focused on the sanitation-related psychosocial stress faced, especially by adolescents during menstruation which makes managing related issues like waste disposal even more difficult (Schmitt *et al.* 2021; Sahiledengle *et al.* 2022). Furthermore, low- and middle-income countries and in rural and poor urban communities IWM suffer from inadequate water, hygiene and sanitary infrastructure (Sommer *et al.* 2018; Robinson & Barrington 2021) including soap, safe water and functional, secure toilets/latrines with private menstrual product disposal are sometimes unavailable (Cardoso *et al.* 2019; Ivanova *et al.* 2019). These factors affect girls' confidence, self-efficacy and ability to participate in daily activities including health and wellness, garbage disposal, etc. These result in a negative attitude towards menstruation and its related issues.

Single-use products are mostly used by IWM since they are the products that people are most aware of, and are often offered free of charge by government and NGO programmes. This makes the usage of such products an acceptable norm since they are promoted and preferred by both the media and nearby ones (Plesons *et al.* 2021). Understanding these products' effects and the processes or components that create them can help find ways to enhance their quality. An IWM's behaviour and sanitary product usage can also affect these results (Anand *et al.* 2022). Due to ignorance of the subject, there have been low investments in mechanisms of MWD. Furthermore, the lack of information on how to identify and manage menstrual waste, and the possibility that it can be disposed of in the environment, generates a lethargy around the whole disposal exercise (Anand *et al.* 2022).

Studies have found that the socio-cultural surroundings, information, attitudes and practices that adolescents are exposed to affect their access to menstrual facts, products and facilities (Muralidharan 2019). Motivated by this finding, our paper emphasises adolescents' MWD behaviour and the variables that affect it. For this, the 'theory of planned behaviour' (TPB) developed and refined by Icek Ajzen (1991) is chosen. It is extensively used to understand and link variables that influence personal intentions and actual behaviour (Ajzen 1991, 2002). The current study attempts to examine the gap in the literature by focusing on drivers of the irresponsible MWD behaviour in adolescents by identifying psychological, social and behavioural factors through the framework of TPB. Furthermore, these factors are put in the broad categories of attitude, subjective norms and perceived behavioural control (PBC), which shape the readiness of an individual to perform a behaviour.

Understanding these factors can help shape governmental strategies to deal with menstrual waste and steer adolescents towards using sustainable menstrual products resulting in less non-biodegradable menstrual waste. To the best of our knowledge, no study has examined MWD behaviour within the framework of TPB. Our goal is to comprehend the social conditioning of IWM, influence their intentions and develop a planned behaviour to practice environmentally friendly MWD. Menstrual waste policies and initiatives are also examined for their challenges, implementation and impact.

BACKGROUND

Rise of sanitary pads and their challenges

Urban India's 2019–2024 consumption of pads is projected at 89.5%, an increase of 12% in the usage of pads (IMARC 2018). Speedy urbanisation, rising incomes, easier product availability, improved mobility and aggressive marketing by media will only expand its use (Van Eijk *et al.* 2016). IWM in India have started menstruating earlier than before, and urban IWM reach menarche earlier than their rural counterparts (Muralidharan 2019). The use of pads is now included in the school curriculum. Urban places generate more disposable menstrual waste, therefore MWD system issues are likely to be worse there than in rural areas.

Table 1 | Previous studies regarding menstrual waste management

Study	Nature of the study	Focus of the study	Important findings	Sample
Bridle & Kirkpatrick (2005)	Field method	Compare degradation rates of tampons, tissues, and toilet paper in natural circumstances.	Compared to tissues and toilet paper, tampons deteriorated less.	Selected nine sites as representative of common plant communities in Tasmanian national parks.
Sommer & Sahin (2013), Sommer <i>et al.</i> (2013)	Review Paper	Explore the after-effects of various disposal practices for used menstrual material in low- income countries.	Sewerage systems suffer from improper product disposal.	
Scorgie <i>et al.</i> (2015)	Qualitative method	Ways in which low-income females manage menstruation and evaluate the effectiveness of current sanitation services in addressing their demands.	All females used commercial sanitary napkins despite knowing about their non-biodegradable. All study sites lacked constant water supply and discrete disposal options.	21 females from three Durban, South Africa sites participated in seminars, in-depth interviews, and the 'Photovoice' method.
Garikipati & Boudot (2017)	Quantitative study	Analysed menstruation practices and initiatives undertaken to improve sanitary care.	Even the urban poor started using sanitary pads, increasing their use from 56 to 64%, demonstrating that development initiatives have reached the poor.	150 women and girls from three slums in Hyderabad, India
Muralidharan (2019)	Qualitative study	To study menstrual issues among unmarried females aged 15–24 in a slum settlement.	Sanitary pad users have trouble changing and disposing pads in their homes, public facilities, and at trash disposal sites due to smaller living spaces and lack of privacy.	26 unmarried women and 10 mothers of a slum in Dharavi, Mumbai.
Roxburgh <i>et al.</i> (2020)	Qualitative study	To study management and perception of women on menstruation.	Secrecy and anxiety about period blood which affects their usage and disposal of menstrual products. Need for private and convenient infrastructure to manage periods. Increase in usage of pads in urban areas.	Interviews of 31 female participants between the ages of 19 and 63 years, living in the city of Blantyre, Malawi.
Robinson & Barrington (2021)	Systematic review	Identify behavioural drivers for the choice of disposal and washing practices of menstrual products.	Physical state of sanitation facilities and social taboos are drivers of the concerned behaviour.	
Plesons <i>et al.</i> (2021)	Qualitative study	State of adolescent menstrual health in low- and middle-income countries.	All social, cultural, financial, clinical and infrastructural aspects need to come together to meet menstrual health needs of adolescent IWM holistically.	Meeting convened by global bodies like WHO and UNDP with experts of identified nine domains of menstrual health.
Alda-Vidal & Browne (2022)	Ethnographic and field research	Explore the socio-materialities of menstrual waste management in the global South.	Interventions for reusable products do not consider inadequacies of the existing toilet-infrastructure and complete burden of managing menstrual waste falls on women.	Semi-structured interviews of 19 women and interviews with different governmental and non-governmental actors in Lilongwe, Malawi.

Used items flushed in toilets often damage underdeveloped sewerage systems. They are sometimes wrapped in plastic, which further thwarts the natural decomposition and disposed with other waste or in open spaces (Budhathoki *et al.* 2018). Lack of infrastructure leads to reckless disposal of menstrual waste in neighbourhoods, causing health dangers.

A female-centric study in Durban, South Africa (Scorgie *et al.* 2015) found that inadequate sanitation systems, which could further clog sewers and contaminate streams, forced 'females' to find innovative ways to cope with their periods, such as burying or burning discarded pads or disposing of them in an opaque plastic bag. Similarly, users' perceptions of garbage disposal facilities can influence how they dispose of waste. In New Zealand, adolescents were of the opinion that tampons could not choke the sewage disposal system (Lynch 1996). However, the majority of older residential structures have small-bore sewers that can only handle water-soluble items (like tissue paper). These points of conflict highlight the need for a fundamental shift in the way that menstrual waste is managed.

Policies and schemes at international and national levels

Organisations like the World Health Organisation (WHO) and WaterAid have done extensive work globally to create awareness about menstruation hygiene management (MHM) (Mahon & Fernandes 2010). MHM has been defined as 'women and adolescents girls using a clean menstrual management material to absorb or collect blood that can be changed in privacy ... and having access to facilities to dispose of used menstrual management materials' (UNICEF & WHO 2014). The UN definition of sanitation emphasises privacy and dignity, referring to a 'female's' rights during menstruation, but ignores MWD. City sanitation planners and designers make the same mistake (Sommer & Sahin 2013). There is no government programme or policy that outlines in detail ways to manage menstrual waste.

No menstrual hygiene goal or indicator addresses MWD. Rashtriya Kishor Swasthya Karyakram, run by the Ministry of Health and Family Welfare in India, and Suvridha Sarathi Scheme solely give sanitary napkins to adolescents aged 10–19 years. The Ministry of Drinking Water and Sanitation recommended to the central government an inter-sectoral approach to MHM in schools but no means were provided to implement it (Muralidharan 2019). The international MHM guidelines emphasise that every adolescent 'female' must have access to and understanding of the infrastructure for MWD. This guideline recommends disposal methods like deep burial, composting, pit burning, etc., depending upon the material of the absorbent (Government of India 2015a).

The 2014 flagship programme by the Government of India, Mahatma Gandhi Swachh Bharat Mission (SBM) Urban, aims to end open defaecation in urban India and establish scientific and sustainable solid waste management. For this, the mission directorate recommends installing sanitary pad vending machines inside female's restrooms. And a portion of these toilets could have incinerators. Unfortunately, both these facilities are part of 'desirable infrastructure' and are missing in many existing toilets (Government of India 2015b).

The latest draft of the national-level menstrual hygiene policy (2023) is progressive in nature. It suggests product manufacturers provide accurate labelling with information such as ingredients, usage instructions, use-by date, disposal guidelines and potential risks or side effects for consumers to make informed decisions. Subsidised oxo-biodegradable pads have been introduced along with the efforts to make sustainable products more affordable and accessible for better MHM and MWD. Different stakeholders, including ministries, must ensure separate toilets, promote eco-friendly and biodegradable menstrual products through self-help groups under the National Rural Livelihoods Mission (NRLM), and raise awareness about the environmental impact of conventional menstrual products. Behaviour change is promoted through programmes that challenge menstrual taboos, promote open talks, dispel period myths and create a supportive environment for IWM (MoHFW 2023).

RESEARCH METHODOLOGY

For the database search, only full-text articles published in English since 1993 were included. Letters to editors and editorials were excluded. A literature review of TPB, MHM and MWD is included in this descriptive study. To gather research publications, Web of Science, Scopus, Science Direct, PubMed and Google Scholar were searched. We went through extensive literature of the last 30 years. Table 1 lists qualitative, quantitative and review studies that address the health and hygiene requirements for IWM during menstruation, as well as the materials and facilities needed for effective period management. Government reports, journal articles, book chapters and conference proceedings were reviewed for theoretical and empirical content. The database search returned 347 articles from all data sources after eliminating all duplications. The criteria for searching the literature included keywords individually and collectively, such as 'menstrual hygiene', 'incinerator', 'waste

behaviour', 'menstrual waste' and 'WASH'. Preference was given to studies published in high-quality indexed journals. Only 88 articles were specifically focused on menstrual waste. After screening of the abstracts, 152 studies were excluded where adolescents, MHM or menstrual waste were not the focus. Eighty-two studies covering clinical trials, consumer behaviour, environmental impact of menstrual products, their degradation and energy consumed in waste management were not included. Furthermore, 41 papers were avoided with similar findings to the ones selected after the final screening. These also covered studies with not much focus on low- and middle-income countries. Sixteen papers were added focusing on TPB or its extensions. After reading the full text, a total of 72 papers were included in the final review.

TPB provided a framework used to investigate how adolescents disposed of menstrual waste. Studies were selected which emphasised such social factors and settings that influence or can potentially shape attitudes of irresponsible MWD.

The focus of the study was on adolescents since they are physically more active, agile, have more lifespan compared to adults and are more adaptable to new changes that can be made using the TPB framework.

We also covered national-level policy documents and schemes run by both central and state governments, including the draft of menstrual hygiene policy 2023, and understood their actual reach and implementation. However, we found very limited papers in the Indian context.

Conceptual framework

TPB is a well-known and widely studied social cognition framework in psychology used to analyse, explain and predict human behaviour. According to TPB, the main cause of behaviour is intention. The individual's overall attitude towards the behaviour, their subjective norms, which represent the social pressure felt to perform the behaviour, and their PBC, which means the difficulty of performing the behaviour, determine intention. Others' opinions also affect this intention. According to TPB, the greater the intention, the higher the likelihood of a behaviour. People may have good intentions but not act on them unless they believe they control their behavioural performance (Ajzen 1991). TPB predicts a person's behaviour at a given time and place. People plan their actions, act on them and consider their goals; therefore, their actions are influenced by their intentions (Aydin & Aydin 2022). TPB gives the hope that changing attitudes, subjective norms and control perceptions can lead to lasting change (Fishbein & Ajzen 2010).

We use the original TPB framework (Ajzen 1993) to examine how attitudes, subjective norms and PBC affect an individual's genuine behavioural intention. Many studies have used TPB to study waste behaviour and various driving pathways including policies, attitudes, knowledge, etc. to this behaviour across industries like agricultural plastic waste (Hao *et al.* 2024), recycling of e-waste (Gabriele & Gabriele 2024), household food waste (Stancu *et al.* 2016) and construction waste (Li *et al.* 2018). Several extensions have been introduced to this theory (Rezaei *et al.* 2018; Moon *et al.* 2021).

The structure of the next section will help us study the elements influencing irresponsible MWD behaviour and is based on the theoretical framework shown in Figure 1.

Factors shaping the attitude

A person's attitude controls their intentions of a behaviour. It is the judgement that is made about a behaviour's performance, either positively or negatively. Therefore, we examine the 'stigma', 'mothers' and 'other alternatives' that fuel this 'attitude'.

Stigma around menstruation

In India and other developing nations, menstruation is taboo and menstrual blood is regarded as unclean and polluting. Shyness, embarrassment and insufficient information on the subject amplify difficulties for adolescents. At Ranchi, India, a survey found that menstruating adolescents are prohibited from religious activities. They cannot shop, cook, wash, serve guests, exercise, put on cosmetics or go to markets. Their mobility was also limited. These detrimental views and practices threaten a menstruator's physical and emotional well-being. However, studying and discussing menstruation with educated elders developed a positive outlook towards menstruation in IWM (Kumar & Srivastava 2011). One's attitude to an issue depends on the source of knowledge.

Mother as a source of information

According to research done in the slums of Mumbai, India, adolescents typically turn to their mothers making them the primary source of information for MHM advice. They discuss menstruation absorbents, food taboos and personal cleanliness (Muralidharan 2019). Many of these mothers are typically uneducated or have barely completed elementary school. Thus, their guidance was inadequate, and the lack of health education programmes in schools made matters worse (Srivastava

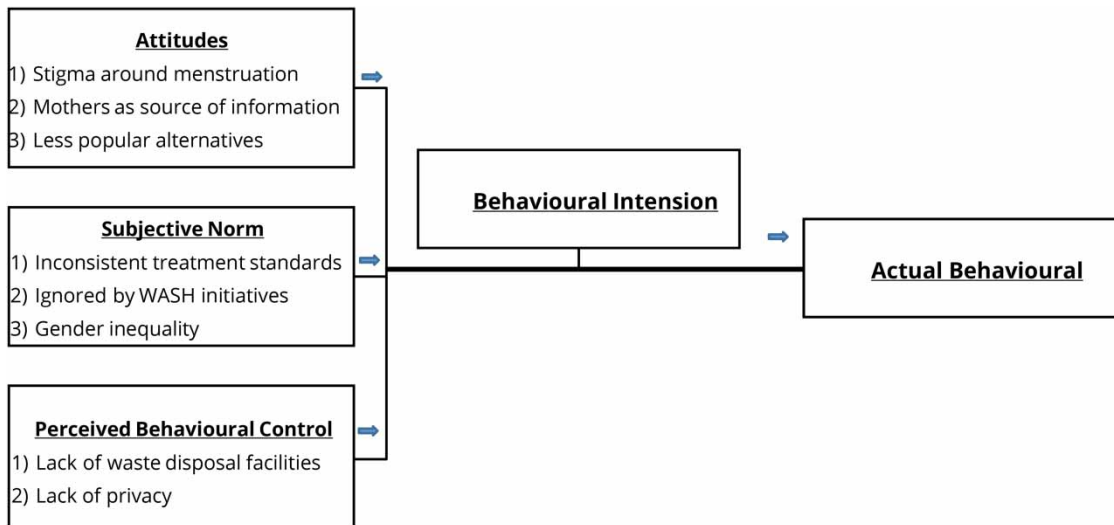


Figure 1 | Theoretical framework for menstrual waste behaviour.

et al. 2017). Kumar & Srivastava (2011) observed that many adolescents regarded mother–daughter discussions regarding menstruation and sexuality as disgusting and unsettling due to the communication gap. They also avoided asking or discussing it at college or the workplace.

Less popular alternatives

Many variables explain the poor use of sanitary pad alternatives like washable or reusable sanitary products, such as menstruation cups, including (a) menstrual blood is hard to hide from men and relatives; (b) lack of handwashing facilities near pit latrines and toilets; (c) inadequate water supply, (d) reusable product washing and sterilisation require lots of water (Bhakta *et al.* 2024) and (e) initial high cost of reusable products (Scorgie *et al.* 2015). As a result of these challenges, IWM are limited to utilising sanitary pads. Let us see how ‘subjective norms’ shape the behaviour of MWD.

Role of subjective norms

‘Subjective norms’ are societal or external pressures on an individual to behave in a specific way, which affects their actual behaviour (Ajzen 1991). Subconsciously, people follow various social norms and cultural characteristics, including the two described below.

Inconsistent treatment standards

The National Sanitation Policy 2008 aims to provide urban poor IWM with clean, inexpensive sanitation, but it does not specify ways to manage menstrual waste. This raises a fundamental issue: how should this waste be categorised?

Solid Waste Management (SWM) Rules, 2016 conflict with Bio-Medical Waste Management Rules, 2016. The former processes menstrual waste like other household garbage, separating biodegradable and non-biodegradable elements. However, the latter refers to it as bio-medical waste which implies that germs will be killed by cremation or microwaves. According to the SWM Rules, 2016, only Bengaluru and Pune in India segregate menstrual waste from other waste. These cities struggle to classify used sanitary products as bio-medical or household waste (Malaviya 2019). Only recently, the national menstrual hygiene policy 2023 suggested local waste authorities to collect, transport and treat menstrual waste according to the Bio-Medical Waste Management Rules, while taking the help of public – private partnerships (MoHFW 2023).

Many studies promote incineration (Crofts & Fisher 2012; Sommer & Sahin 2013; Kaur *et al.* 2018); the US Environmental Protection Agency and WHO found that incomplete or inefficient cremation can produce dioxin and furan. These gases can hinder reproduction and development, the immune system, hormones and can also cause cancer (Division of Toxicology 2001). Additionally, it is challenging to set up incineration camps in confined urban locations, particularly inside washrooms.

Ignored by WASH initiatives

MWD has also been overlooked by the WASH (water, sanitation and hygiene) sector and its activities. The Total Sanitation Campaign (TSC) 1999, a WASH effort by the Indian government (Mahon & Fernandes 2010), prioritised community infrastructure for menstruators bathing and toilets over MWD development. TSC was later improved and renamed as SBM, a major WASH initiative, which also does not focus on MWD.

In its first phase, SBM was only focused on building individual household toilets and bringing behaviour change to improve its usage, and states were only suggested to build infrastructure for safe MWD (MoDWS 2014). In the second phase, there was insistence on distributing pads in school. Campaigns like 'Chuppi Toro, Swasth Raho' emphasised incinerators for safe disposal, but schools are still not required to install them (Bhakta *et al.* 2024).

SBM did not insist on the segregation of menstrual waste at the household, institutional or workplace level which is often lacking. It also did not give specific attention to components associated with MHM, such as women's cleanliness, water supply, and the availability and accessibility of disposable sanitary napkins. In a study in rural Odisha, only 22.5% of women responded to having water and soap in their menstruation management area under SBM, which would affect their choice of a reusable product. There is low usage of toilets built under SBM since they were low-quality buildings, lacked access and had scarcity of water (Behera *et al.* 2022). Similar WASH programmes like Nirmal Bharat Abhiyan (2012) focused on eradicating open defaecation but did not explicitly mention or focus on MWD. And policy guidelines of the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) did not even mention MHM. None of them have focused on creating an overall conducive environment for MHM and MWD to address social stigmas and behavioural issues. Furthermore, they failed to provide a safe, clean, private and lockable sanitation facility that can significantly improve the MHM experience.

Gender inequality

Males mainly, along with policymakers and implementors, have left IWM to manage periods. Many men sport a demeaning attitude concerning menses and IWM (Wong *et al.* 2013). Menstruation has been a taboo and rarely addressed in men's education, which contributes to this negativity. Thus, many IWM were teased and humiliated at school, college and workplaces (Peranovic & Bentley 2017). A survey found that many men thought menstruation was a 'woman's business', hence they should not be concerned about it. Insufficient emotional support and care (such as buying pads or tampons, offering hot water bottles or bags, etc.) made menstruation cycles harder for IWM.

Due to severe gender disparity, voices and needs of the IWM are often ignored. In Nepal, WaterAid (2009) found that low literacy, lack of confidence and societal conventions hindered representation in management committees, training and employment opportunities. Since men thought 'females' to be 'uneducated and incapable of decision-making', they discouraged them from speaking in meetings. This led to low menstrual hygiene awareness among policymakers and implementers, resulting in infrastructure inept to the needs of IWM (WaterAid Nepal 2009).

Perceived behavioural control

The other major category of the theoretical framework is PBC which indicates the amount of struggle or comfort with which an individual is able to conduct a behaviour (Ajzen 2002).

Lack of waste disposal facilities

Muralitharan (2019) found that adolescents in cramped slums found disposing of discarded sanitary pads cumbersome and humiliating. Lack of disposal facilities forced them to leave their homes to dispose of used sanitary pads in public gutters, revealing their menstrual status. This disposal procedure forced some adolescents to utilise cloth pads.

Some IWM voiced their displeasure at the reckless disposal of discarded pads or fabric in translucent polybags by other IWM. They occasionally discovered such bags in open dumps intended for regular household waste. Some participants of the study mentioned flushing used feminine hygiene products firmly wrapped in toilet paper or plastic bags. These respondents were aware that the disposal of sanitary pads in toilets leads to clogged drains but ended up doing it due to a lack of dustbins inside toilets or bathrooms (Scorgie *et al.* 2015). Other times, these used pads are frequently thrown directly into trash cans without any packaging. Later on, these are separated from the usual household waste by local waste collectors using bare hands, making them vulnerable to many infections and diseases like Hepatitis and HIV (Sambyal *et al.* 2019).

Another MWD-associated waste facility is an incinerator. But merely setting up an incineration camp does not guarantee its efficient usage as it has been proved in the cases of schools in Tanzania and Uganda, where issues of privacy and anonymity were ignored and adolescents had the fear of being seen while going to the incineration camp set at a distance from toilets (Crofts & Fisher 2012). School-going IWM did not want to be seen disposing of used pads. Furthermore, menstrual waste was not collected separately from waste bins placed inside toilets. In India, WaterAid tried to remedy this problem by assisting in building incinerators inside female's restrooms or on its outer wall with an inlet provided inside the restroom or toilets (Mahon & Fernandes 2010).

Lack of privacy

In a study by Mahon & Fernandes (2010), the lack of safety and privacy won over all other concerns for IWM including the ones related to poor hygiene and sanitation facilities. This concern is also exhibited in different geographical contexts covering Egypt (El-Gilany *et al.* 2005), Kenya (McMahon *et al.* 2011) and Bolivia (Long *et al.* 2013). Developing nations continue to pay little attention to this issue even though the South African Human Rights Commission (2014) declared privacy a fundamental human right.

The lack of separate waste disposal systems and poorly constructed toilets shared by many family/neighbourhood members heightens the fear of someone seeing the menstrual blood (Scorgie *et al.* 2015). This encourages adolescents to throw away discarded menstruation products carelessly in an unhygienic and environmentally unfriendly way.

DISCUSSION

The theoretical framework used in this study helped us identify factors that affected menstrual product waste disposal by IWM. In addition, these variables were grouped under the broad categories of 'attitudes', 'subjective norms' and 'perceived behavioural control', TPB determinants. We find out that a person merely being aware of the serious consequences of a harmful habit does not guarantee the discontinuance of that habit. He/she requires a conducive environment to practice a good habit. Several factors in this study were covered that stopped IWM from disposing of menstrual waste in a responsible way or switching to reusable products. Understanding and modulating these drivers may help improve MWD behaviour and shift the complete blame for irresponsible MWD off IWM. Since adolescents are susceptible to social influence and are young, their behaviour can be changed.

Earlier studies have shown that the way menstruation is framed or presented affects the way it is perceived (Chrisler *et al.* 1994). The need for proper orientation towards MWD from educated mothers and its inclusion in the school curriculum will help develop a responsible and hygienic practice.

Much-needed emotional support and care from men are also required for IWM to divert their attention towards practising responsible MWD. Since men were the major decision-makers and all the financial powers rested with them (Scorgie *et al.* 2015), in many cases, they did not give money to IWM of the house to buy sanitary pads or menstrual cups. Reusable menstruation products cost more than sanitary pads, making them difficult to afford. As the male of the household made the decision to build a toilet, decisions about proper product disposal were put on hold.

IWM were powerless to speak up against the subpar sanitation infrastructure present in workplaces, schools and households, or the unnecessary rules dictated by society. In Tanzania and Ethiopia, the usage of cheap products and other such practices put a huge impact on health in the form of toxic shock syndrome, reproductive tract infections (RTI) and other vaginal diseases (McMahon *et al.* 2011).

Table 2 shows potential outputs and outcomes if adequate input is provided and designed along the TPB framework. This framework will help plan activities and solve the issue of irresponsible MWD both at the level of policy and implementation (Weber *et al.* 2019).

Even today much of the resources are usually spent in building toilets or in procuring menstrual products but hardly any thought is given to managing menstrual waste including placing separate wastebaskets for menstrual waste near public toilets. Similar inadequacy and ambiguity are also reflected in policies of waste management on the categorisation and treatment of menstrual waste. It also does not mention any kind of fine or punishment to be imposed on local authorities for not collecting or treating the concerned waste safely (Government of India 2008).

These observations point to the failure of local sanitation service providers and city planners to meet the needs of IWM and provide proper, safe and scientific waste disposal systems for used sanitary products (Scorgie *et al.* 2015).

Table 2 | Output and outcomes of the framework

	Output	Outcomes
Attitudes	Better understanding of the factors influencing MWD and accordingly prioritise actions MWD is included in school curriculum Gradually shift towards reusable menstrual products	Awareness about consequences of MWD Positive outlook towards menstruation Less menstrual waste generated
Subjective Norm	Placing separate waste baskets for menstrual waste and incinerators inside washrooms Clarity about treatment of menstrual waste in policies Increased investments into creating more menstrual waste segregation, collection and disposal infrastructure Employ state of the art technologies to handle it responsibly	IWM handling menstruation in a dignified way at both workplaces and schools Streamlined systems to handle this waste More robust policies with better stakeholder and govt interaction Get proper assessment of the waste No disposal of menstrual waste in toilets
Perceived Behavioural Control	IWM participating in creating infrastructure of their concern	Increased investments in MWD infrastructure Pro-active attitude of males towards IWM in handling menstruation

CONCLUSION

In the coming years, the waste load of used menstrual products is only going to increase (IMARC 2018). Therefore, educating IWM about environmentally safe MWD is crucial. There are various ways of disposing of menstrual waste like incinerators, latrines with chutes, reusable cloth pads and biodegradable products, which can be implemented with proper planning (Kaur *et al.* 2018). The implementation of timely interventions and administrative measures has the potential to yield significant impacts on results (Mathur & Sreekumar 2022).

Our study is not devoid of any limitations. Firstly, this theoretical framework has not undergone any empirical testing and is based solely on the available research. Second, due to the paucity of research in this field, the present study could only draw from a small body of literature that examined the behaviour and attitudes of IWM towards MHM and MWD. Despite these drawbacks, the study offers a solid framework on which other research may be built.

Future research on MHM should also consider patriarchy, age, economic value, environmental issues and local norms. To uncover the impact of culture and social norms on the perspective and behaviour of IWM from various regions of the nation, an ethnographic study can also be carried out. Other research can go to the micro-level and focus on the drivers of the intentions of IWM which can help find ways to change their mindset. Focus can also be brought on men and the role of male-centric institutional structures. An empirical study can also be conducted based on the theoretical framework.

This study will arm decision-makers, implementers and civil society with the tools they need to deal with the issue of an ever-growing mountain of non-biodegradable menstrual waste in a realistic and responsible manner. It will also help influence the behaviour of adolescents through socio-cultural factors identified in the framework to enhance the use of sustainable menstrual products.

It will also give policymakers knowledge about the various social pressures adolescents face as well as how little support males give to them in their families when it comes to addressing menstrual-related difficulties. From the beginning, positive and healthy discussions on menstruation and hygiene should be encouraged in schools among all genders. This will develop an informed positive outlook on menstruation in them. Knowledge about safe disposal of non-biodegradable menstrual products should be made part of the curriculum. Teachers and students should be given training to promote the use of sustainable menstrual products. Students must be educated about the negative effects of irresponsible disposal behaviour on the environment and society. The government should clarify and disseminate information about the segregation of menstrual waste from other waste both at the household and school levels which will instil trust in adolescents and make them responsible for their generated waste. They should also take steps to make alternatives to pads and tampons more popular, affordable and accessible for the willing consumers. All the above steps, if implemented, will improve the attitude and make safe MWD a norm easy to follow for adolescents. Furthermore, these will help policymakers and implementors build a conducive environment for behavioural change in adolescents for a responsible MWD. Perhaps in the future, the intended audience (IWM especially adolescents) will be consulted when creating infrastructure specifically for them, such as restrooms and incinerators, and will be able to dispose of menstrual waste properly.

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DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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