Sanitary Pads For Developing Nations: Medical, Ethical, and Design Issues

P A Clark, A D McClendon, A Maheshwar, T Nguyen, O Nguyen, M McNamee, C Gareis

Abstract

The natural process of menstruation has excluded women from receiving an education and working in many parts of the world. Menstruation is a natural cycle that occurs monthly for non-pregnant women once they have reached menarche. If provided the proper supply of pads and tampons, bleeding can be controlled; however, that is not the case with women in developing nations. Unfortunately, many women in these nations then stop attending school due to the insufficient means and lack of knowledge of proper care while menstruating and out of fear that the blood may seep through their clothing. The lack of sanitary pads has greatly impacted young women in India, because they are dropping out of school due to this problem. As a result, young women in India are not receiving a proper education, their literacy rate is much lower than boys and they fail to be able to attain the careers many of them dream about all their lives. This impacts not only these young women, but their families and society as a whole. To minimize the development of these conditions, a total of four prototypes of sanitary pads will be proposed focusing on human-centered design in an attempt to create a pad that is antibacterial, adaptable, affordable, and sustainable. The phases and methodology behind the creation of these prototypes will be included. In addition, we are advocating the creation of small microfinancing groups of women in India who can make these sanitary pads and sell them for a reasonable price. This will not only empower the young women who use these sanitary pads but will also empower the women's groups who take our designs and implement them in India. This is medically, ethically, and financially the right thing to do.

INTRODUCTION

The natural process of menstruation has excluded women from receiving an education and has impacted their employment in many parts of the world. Menstruation is a natural cycle that occurs monthly for non-pregnant women once they have reached menarche. Young women are often in school when they start puberty, as the age range is 11-14 years of age. Once menstruation has started, blood will exit from the uterus and proceed into the vagina. If provided the proper supply of pads and tampons, bleeding can be controlled. In various cultures, menarche is celebrated as a rite of passage since the woman is able to partake in the gift of procreation. Unfortunately, many women in other cultures stop attending school due to the insufficient means and lack of knowledge of proper care while menstruating and out of fear that the blood may seep through their clothing.

In the case of rural areas, menstruation is often seen as a taboo. The discharge of blood is considered impure, sometimes associated with evil spirits, in which it is pertinent to expel from the body or else could lead to the development of diseases [1]. As a result, women abstain from certain practices such as cooking, religious functions, touching other males, and sexual intercourse [2]. Since menstruation is regarded as shameful and even fearful, women withdraw themselves from social practices claiming they have become “untouchable.” Even in the context of familial relations, mothers are less inclined to inform their daughters about the menstrual cycle, giving them minimal to no instruction, believing that it is a “matter to be understood over time” [3]. In effect, women are unaware of the means of care and disposal of cloth used giving rise to sanitation issues and infections. Consequently, women have a lack of knowledge and understanding of menstruation, puberty, and
overall reproductive health.

As a result, this creates an unhealthy cycle of oppression and causes women to feel ashamed, even though menstruation is a natural process. In an attempt to improve the overall quality of life of women, this article seeks to further examine the implications involved in menstruation in four main areas: medical, design, economics, and ethical. The investigation via the medical avenue will explore the physiology, barriers, and potential infections regarding the cycle. To minimize the development of these conditions, a total of four prototypes will be proposed focusing on human-centered design in an attempt to create a pad that is sustainable, affordable, sanitary, and adaptable. A recommendation will be drafted from the economical perspective to investigate the potential of microfinancing the sanitary pad in developing nations in the hopes to further empower women. Finally, an ethical analysis will be given to justify the use of these sanitary pad prototypes in an effort to enable young women to receive proper health care, attend school, and receive the necessary education to advance themselves and their families.

While this is a cross-cultural issue, the article will be primarily focusing on the developing nation of India as a case study. According to recent figures, males in India have a literacy rate of 75%. However, as in many other countries, women fall short of this, showing a literacy rate in India of only 53% [3]. The National Center of Biotechnology Information states, that over 23% of women in India will stop attending school because they start to menstruate [4]. In addition, since they are given minimal guidance, many menstruating women in India use an old cloth as a menstrual absorbent, which is normally reused. To help with the absorption the women, particularly in India, sometimes use ashes, newspapers, dried leaves, and husk sand [4]. Unsanitary materials such as these can lead to infection and serious illness. Since women have a lack of education about menstruation, this then affects their overall reproductive health.

Once these issues are addressed with adequate resources, it can lead to better education, employment, and empowerment opportunities. With the implementation of beneficial sanitary napkin programs, they would be empowering and improving the lives of women in countries such as India. If young girls were able to leave the house without the risk of unsanitary and unpleasant leaking, they would be more likely to attend school and receive higher education, as well as education about menstruation itself. With an increase in the education of females, a rise in women in the workforce would come subsequently. Allowing girls to realize that a natural part of being a woman should not exclude them from the ability to be successful would both empower women and allow for important contributions to society. A reusable and sanitary product design would allow women to better prepare themselves for entry and advancement in the workforce. Reusable sanitary napkins could open the door to job opportunities for women to sew and produce these products in local facilities. This further empowers women through the fact that, not only can they have access to this product to improve their quality of life and chance for opportunities, but they can also make the product themselves.

MEDICAL ANALYSIS

Figure 1

Menstruation is a normal hormonal process that occurs in a woman’s body every month. The monthly shedding of the uterine lining causes bleeding which typically lasts for 3-5 days. The average menstrual cycle lasts from 28 to 35 days and is divided into two phases. The follicular phase begins with the onset of menses and ends at a luteinizing hormone surge after which the luteal phase begins and ends with the next menses [5].

In many cultures, menstruation is not widely accepted as a natural and physiological phenomenon. In some cultures, the beginning of menstruation is deemed to be auspicious and the power of procreation is actually celebrated, while in others even talking about feminine hygiene publically is a
societal taboo. Women in many developing countries are subjected to multiple restrictions during their menstrual cycle as they are deemed “impure or unclean” [6]. Restrictions can include anything from entering the kitchen, cooking, going to a religious event or a relative’s home, or even sleeping in the same bedroom as others. They are often treated like untouchables and are given separate utensils, bed sheets, and are told to not touch certain foods as “they will get sour” [4,7]. Sadly, young girls from ages 12-18 while they are menstruating are not sent to school. Multiple surveys have shown that between 20-30% of adolescent girls drop out of school after they start menstruating [8].

Along with the taboos and myths associated with menstruation, the state of female hygiene is inadequate in certain developing countries [9]. Risk factors for infection associated with the use of sanitary pads are related to the material (procurement and cost) as well as the practices related to washing, drying, and storing the sanitary pads [10].

In October 2010, a country-wide study done by Nielsen et al and Plan India revealed astonishing statistics regarding the state of unhygienic sanitary practices and menstrual health. “Only 12% of India’s menstruating women (355 million) use sanitary napkins” [8]. A large number of women in India cannot afford sanitary pads or underwear and age-old practices that have been passed down from mothers to daughters is still the preferred method [8]. Many women use an old reusable cloth with cotton as a sanitary pad.

Shockingly, uses of absorbable materials such as ashes, newspapers, husk sand, and dried leaves have also been reported. Due to the lack of resources, women are forced to wear these makeshift pads for extended periods of time. The survey in India showed that “an incident of Reproductive Tract Infection (RTI) is 70% more common among these women” [8].

All women should ideally be taught a standardized washing technique with clean water and bactericidal solutions. However, due to inadequate washing facilities and the embarrassment and secrecy associated with menstruation, women typically have not been able to wash pads in a public or even semi-private area and have resorted to using dirty drain water to clean pads [9]. Similarly, women are hesitant to dry these cloths in a public place and often wear moist pads, which further precipitate infections. Lastly, pads are being stored in unclean locations with other sources of contamination [9].

Medically, these unhygienic menstrual practices can lead to ascending urinary tract infections and reproductive tract infections from bacterial or fungal organisms [11]. These women are also at a higher risk for cervical cancer and infertility. Per the CDC, reproductive tract infections (RTIs) are divided into three types of infection: sexually transmitted diseases, endogenous infections, and iatrogenic infections. Endogenous infections are caused by overgrowth of organisms in the normal genital tract of a woman [12]. Also, menstruation in itself can lead to bacterial contamination due to a disruption in the mucus barrier in the cervix and a degree of retrograde menstruation. A UNICEF study done by Torondel et al, revealed that around 60% of women diagnosed with bacterial vaginosis and urinary tract infections use reusable pads [13].

Vaginitis is defined as an infection, inflammation or change in the normal vaginal flora. Symptoms can include vaginal itching, discharge, odor, burning, redness, painful sexual intercourse, or pain with urination or spotting [14]. The three most common types of vaginitis include bacterial vaginosis (BV) most commonly caused by Gardnerella vaginalis, vulvovaginal candidiasis (VVC) caused by Candida albicans or glabrata, and trichomoniasis caused by Trichomonas vaginalis [14]. Both BV and VVC are primarily non-sexually transmitted diseases and could be introduced by poor female hygiene and through unhygienic material used for creating pads [15].

Bacterial vaginosis is characterized by an imbalance of the normal vaginal flora. Women with BV are at higher risk of adverse pregnancy outcomes such as preterm delivery, postpartum fever, plasma-cell endometritis. Sequelae also include an increased risk for acquiring sexually transmitted diseases such as herpes simplex virus type 2, gonorrhea, chlamydia, and HIV infections. BV is also a factor in the development of pelvic inflammatory disease and precancerous lesions such as cervical intra-epithelial neoplasia [16-19].

Urinary tract infections (UTIs) are the most common infection in menstruating females’ due to unsanitary cleaning habits and menstrual hygiene. The pathogenesis of UTIs in women is due to bacterial colonization of the vaginal introitus with subsequent ascension via the urethra into the bladder and via the ureters to the kidneys. Escherichia coli is the most frequent organism associated with UTIs. Symptoms include painful urination, increased urinary frequency, urinary urgency, and suprapubic pain. If the patient develops fever and systemic signs such as chills
and rigors, flank pain, the infection has usually extended beyond the bladder [14].

The significant gaps in knowledge and awareness regarding menstrual health must be bridged not only for better health outcomes but also for women empowerment. Looking forward, the focus needs to be on creating an affordable, hygienic, sustainable, accessible sanitary pad that would improve quality of life for these women. An ideal sanitary pad must use materials that are easy to obtain, cost effective, and anti-bacterial. The design, cleaning, and drying techniques must be standardized and easy to teach to all women despite education and skill level. Also, provision of adequate facilities for sanitation and washing should be made available for women.

Therefore, this article further proposes four prototypes that can potentially accommodate these factors.

DESIGN RESEARCH METHODOLOGY

“Human-centered design research encompasses a set of methods and practices aimed at getting insight into what would serve” or best resolve a need by an end user [20]. This context transcends the general framework of research that considers knowledge claims, strategies of inquiry, and methods of data collection and analysis [21]. In order to solve problems, designers gather data, investigate and test materials, observe individuals, generate sketches, consult specialists in other disciplines, and produce prototypes. Typically, design is “understood as the activity of giving form to manufactured products” [22]. This is followed by iterations of the framing and problem solving stages. Along with seeking innovative solutions for end-users, designers focus on experiences by “influencing the emotional connection between customers and products” [22].

Over a year’s time, the sanitary pad project applied design research; however, the product analysis was more directed with the inclusion of two design researchers from Drexel University on the team. The benefit of interdisciplinary design research is the intersection of different perspectives and processes across fields. These positions were articulated in strategic meetings, where the disciplines of medical ethics, medicine and health management, biology, design, and design research collaborated. With the refined scope of the sanitary pad project in January 2017 and the partnership of two academic institutions (Saint Joseph’s University and Drexel University), questions were formulated about material properties, performance and sustainability, manufacturing, end-user experience, and cost effectiveness.

The engagement brought design thinking to the helm of the project. “Design thinking … approaches problem solving from the point of view of the end user and calls for creative solutions by developing a deep understanding of unmet needs within the context and constraints of a particular situation” [23]. Young girls in developing nations that are experiencing their first menstruation with the pressure of cultural taboos and limited access to affordable hygiene products compelled this research for additional solutions.

Phases of the Sanitary Pad Project

In December 2016, the sanitary pad investigation was initiated through a group project in a course titled Just Healthcare in Developing Nations at Saint Joseph’s University. A four-member, undergraduate student team produced an informational brochure and prototype. The tri-fold brochure detailed how to make a sanitary, reusable menstrual pad (Figure 2). Four components were included in the leaflet: (a) a six-step image presentation of creating a homemade pad; (b) a three-step description on how to clean the pad; (c) an explanation of a period and the menstruation process; and (d) a period cycle calendar for tracking by the end-user. This outcome concluded the first stage of the project with the original team and academic advisor.

Figure 2

Product Brochure for Sanitary, Reusable Menstrual Pads created by students from the Just Health Care in Developing Nations class at Saint Joseph’s University.

Commencing in late December 2016, the second phase involved a deeper examination of the initial fabric pad prototype for user effectiveness. This resulted in the onboarding of specialists in textile materials, product development, and design research methods. A new eight-member team was formed representing medical ethics,
biology, healthcare, design, and design research. By early January 2017, a review of textile properties spurred investigation into sustainable materials that differed from the Polyurethane Laminate (PUL) fabrication used in the original prototype. Testing revealed that the laminated fabric, while allowing moisture to absorb on the cotton jersey knit, was not fully waterproof on the backing side. With repeated washing and wear, laminate backings and water-repellent finishes that are applied to textiles will reduce in effectiveness over time.

Furthermore, it was determined that hand or machine sewing of the PUL material would create needle perforations that would permit liquids to leak from the pad. This launched research into bio-textile, antibacterial, and wicking fibers including bamboo, lotus, kapok, and banana. Design specialists on the team noted that fibers with inherent moisture absorbency, evaporation, and antimicrobial features would provide safer options for fabrics that contact the skin than chemical finishes. Bamboo fiber is suitable for garments that have exposure to water and for absorption products that touch the skin due to its antimicrobial properties [24]. Equally, existing suppliers of comparable products were explored including TENA®, a global leader in incontinence products, Zorb®, a leading brand of super absorbent fabrics, and Samatoa Lotus Textiles, an innovator of green and ethical fabrics.

Two group members travelled to India and collected data on cultural attributes, regional textiles, climate issues, related products in the marketplace, and population needs. These trips revealed existing means of managing feminine hygiene. One of the prevailing sources of inspiration was Eco Femme, a line of washable cloth sanitary napkins widely used in India (Figure 3) [25]. The napkins range in absorption level and feature a 100% cotton flannel front, a PUL leak-proof backing, and metal snaps, allowing for comfort and security. Eco Femme products can either be purchased premade or as a kit from which to hand-sew, as shown in Figure 4 [26].

Subsequent outreach in Punjab (state), revealed that on average, out of ten girls aged 13 to 28, approximately seven were already using some kind of sanitary napkin and were satisfied. In other global communities, correspondence with African missionaries reaffirmed the use of cotton in the fabrication of sanitary napkins. Based on existing examples, it was determined that an easy-to-sew prototype made of natural materials that are easy to source in any given community would be imperative to its adoption.

From March through September 2017, the activities of ideation, evaluation, and implementation occurred, representing the third phase. “Rough sketches, prototypes, storyboards, or stories to communicate the findings and explore alternative solutions” are desired outcomes from ideation [27]. Team members sourced textiles domestically (Pennsylvania) and internationally (India), conducted further medical, social and product research, investigated potential
collaborators, and sought end-user feedback. During this period, prototypes were generated by hand and sewing machine using a variety of textile materials. Since existing washable feminine hygiene products feature both a breathable cotton textile and a more water-resistant backing, three different textiles were sourced on historic Fabric Row in Philadelphia, PA:

1. **Rain-wear textile**: a plain weave fabric with backed/treated underside that is water resistant; used for the underside of the napkin

2. **French terry**: jersey knit fabric with low pile for absorption; an option for the topside of the napkin

3. **Cotton flannel**: plain weave woven fabric with soft, brushed surface; an option for the topside of the napkin

Researchers documented construction techniques, patternmaking shapes, and moisture management data. In designing the napkin, researchers aimed to determine a preferred method of fabrication and a preferred design to manage moisture absorption. Thus, two binary categories were discerned in order to compare and contrast fabrication method and design:

**Figure 5**
Design Prototype Digital Sketches from Research Team Designers.

Because of the design simplicity of the sewn-in category, researchers experimented with two different mechanisms to secure the napkin: a ribbon (or similar trim) that is sewn to the napkin and a tie that is part of the pattern piece. Because of the complexity of the integrated tie, the integrated tie was executed by machine. Sewn-in prototypes involve the initial stitching of several layers of filler fabric to the prototype (rendering the filler unremovable), whereas pocket prototypes allow for the user to insert and replace as many layers of filler fabric as desired. Technical specifications and order of sewing operations are as follows:

**Figure 6**
Prototype 1.1 Sewn-in layers with ribbon tie

Pieces: 1 terry piece, 1 rain-wear textile piece, 3-5 cotton flannel layers, 2 5-inch ribbons (or similar trim)

1. Top stitch cotton flannel layers to wrong side of terry piece at 0.25” (wrong means the underside of the textile).
2. Stitch ribbons to each side of right side of combined terry piece.
3. Tuck ribbons so that they do not extend past width of combined terry piece. Stitch combined terry piece to rain-wear textile piece, right sides together, leaving approximately two inches open at either long end. Turn entire piece inside out.
4. Top stitch ends closed at 0.25”.
Figure 7
Prototype 1.2: Sewn-in layers with integrated tie

Pieces: 1 terry piece, 1 rain-wear textile piece, 3-5 cotton flannel layers

1. Top stitch cotton flannel layers to wrong side of terry piece at 0.25”.
2. Stitch combined terry piece to rain-wear textile piece, right sides together, leaving approximately two inches open at either long end. Turn entire piece inside out, taking care to press out the integrated ties.
3. Top stitch ends closed at 0.25”.

Figure 8
Prototype 2.1: Pocket with ribbon tie

Pieces: 2 terry pocket pieces, 2 rain-wear textile pieces, 2 5-inch ribbons (or similar trim)

1. Turn straight edge of pocket pieces under 0.25” and stitch to secure.
2. Stitch wrong sides of pocket pieces to right side of one rain-wear textile piece.
3. Stitch ribbons to each side of right side of combined rain-wear textile piece.
4. Tuck ribbons so that they do not extend past width of combined rain-wear textile piece. Stitch combined rain-wear textile piece to remaining rain-wear textile piece, right sides together, leaving approximately two inches open at either long end. Turn entire piece inside out.
5. Top stitch ends closed at 0.125”.
Figure 9
Prototype 2.2: Pocket with integrated tie

Pieces: 2 terry pocket pieces, 2 rain-wear textile pieces

1. Turn straight edge of pocket pieces under 0.25” and stitch to secure.
2. Stitch wrong sides of pocket pieces to right side of one rain-wear textile piece.
3. Stitch combined rain-wear textile piece to remaining rain-wear textile piece, right sides together, leaving approximately two inches open at either long end. Turn entire piece inside out, taking care to press out the integrated ties.
4. Top stitch ends closed at 0.125”.

Finally, the synthesis of research and findings underscored the fourth stage. This integration took place at each meeting throughout the project’s life. Scholars have noted that “the intensity of interaction between individuals with diverse intellectual perspectives brings both creativity and interpersonal strife as they collaboratively grapple with a problem, its solution, and practical development” [28]. Conflict was not a hindrance with the team, feasibly due to the blend of junior and senior scholars and a balance of discipline support between science, healthcare, and design. Members were galvanized by different perspectives and specialist knowledge, cataloging it as opportunity rather than a barrier.

Additional themes assessed in June and July of 2017 were product launches to new markets and considerations of target population, competition, manufacturing, and scaling. “To achieve the best mix of responsiveness and efficiency for the market being served”, an understanding of raw material procurement, production methods, inventory needs, and regional infrastructure was crucial [29]. This coordination activity, known as supply chain management, has had rapid growth among businesses with global product development. For this research project, the supply chain became a pivotal discussion as the reusable menstrual pad was contingent on recommended textiles that are accessible for the end-user as raw materials.

In October of 2017, this phase shifted from extended prototyping and testing to the dissemination of the team’s research data. It was agreed that the interdisciplinary project would be more meaningful as a case study to inform and empower women in Developing Nations on the team’s findings, implications, and recommendations. Team member exits, challenges to conduct a full ethnographic study with human testing, and physical distance from the region of implementation were limitations that guided this decision. Nonetheless, the team acknowledged the significant benefits of experiential learning from integration and innovation among diverse fields of practice during the year long process. The sanitary pad project had true synthesis through collaboration, design thinking, prototyping, and iteration, allowing “a response to the problem … and the generation of solutions” through published research [30].

MICROFINANCING AND ECONOMICS OF SANITARY PADS

The goal of the sanitary pad project was to design a cost effective, anti-bacterial sanitary pad that can be implemented in developing nations like India by way of an accessible and sustainable business model made possible through microfinancing. “Microcredit, or microfinance, is banking the unbankables, bringing credit, savings and other essential financial services within the reach of millions of people who are too poor to be served by regular banks, in most cases because they are unable to offer sufficient collateral [31]. Globally, more than 3 billion people seek access to formal financial services such as loans, savings, and money transfers [32]. However, they are generally denied financial services based upon the inability of candidates to meet minimal qualifications such as evidence of collateral, steady employment, and a verifiable credit history in order to gain traditional credit. Proponents of microfinancing believe that access to these types of financial instruments will elevate the poor and the marginalized out of poverty. “When credit is extended directly to individuals and communities, self-sufficiency and thus the ability to access or purchase life-improving technological advancements- healthcare, farming techniques, digitized information- is not far behind. Access
to technology is ultimately what separates good livelihoods from poor ones and microfinance is a proven method of bridging the gap [33].”

Highlighting microfinance as an instrument of socioeconomic development, the United Nations declared the year 2005 as the International Year of Microcredit [34]. The proclamation called for “building inclusive financial sectors and strengthening the powerful, but often untapped, entrepreneurial spirit existing in communities around the world [34].” It is estimated today that between 70 and 750 million people across the globe utilize microfinancing [34]. The United Nations underscores the use of microfinance and microcredits as an instrument to improve the lives of those living in developing countries.

The lack of health services, especially issues related to women, creates cost burdens hindering economic development. Direct economic costs are incurred through the treatment needed after contracting bacterial diseases, along with the overall cost of ill health on the nation’s economy. The costs of treatment for bacterial diseases are burdens for families across the developing world, hindering education for children and work for adults. Moreover, ill health directly correlates to economic loss. There are lost economic contributions of the sick or prematurely deceased, as well as lower productivity resulting from sick and less educated workers. In addition, indirect costs may accrue from lost work and lower productivity of those who care for the afflicted.

By partnering with a non-governmental organization (NGO), the Institute of Clinical Bioethics aims to implement the proposed sanitary pad prototypes in India and other Developing Nations. Characterized by their independence of government, NGOs are non-profits that are motivated to serve humanitarian, social, or cultural interests [35]. NGOs function by “providing goods and services not usually supplied by the state or the private sector; help the government to achieve its development objects by providing public information, education, communications campaigns, etc.; and organize citizens to voice their aspirations concerns, and alternatives for consideration by policy makers [36].”

The Institute will partner with an Indian NGO and possibly the Menstrual Hygiene Management Project at the refugee camp in Chad, Africa to create a pilot microenterprise program that will bring the sanitary pad prototypes to India and possibly to the Chad refugee camp in Africa. The mission of both organizations is to partner with local NGOs, religious institutions, and community-based cooperatives to design and implement innovative, economic strengthening programs with the goal of enabling these communities and households to provide sustainable care and support for young women and other vulnerable people. The hope is to microfinance this project with local Indian women’s groups to help empower women in Developing Nations. The two separate initiatives: social services and economic development through microfinancing combine into a comprehensive model to benefit the poor and vulnerable.

Initial loans from the NGOs can range from US$15.00 – US$500.00 with an interest rate of 6.0% to 15.0%. The loan periods range from 6 months to 12 months depending on the amount of the loan. Receiving the next loan amount is contingent upon repayment of the previous loan in full. Repayment dates are based upon each loan agreement wherein loans are repaid either monthly or bi-weekly.

By collaborating with the Institute, business members will learn how to properly build and maintain menstrual hygiene. Through this model, the Institute of Clinical Bioethics will increase the proportion of people in these Developing Nations that have access to health care and education while facilitating an opportunity for the poor to elevate themselves out of poverty through a sustainable business model.

ETHICAL ANALYSIS

Article 26 of The Universal Declaration on Human Rights states clearly:

Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit. Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms. It shall promote understanding, tolerance and friendship among all nations, racial or religious groups, and shall further the activities of the United Nations for the maintenance of peace. [37]
Access to education is a basic human right and is vital for our existence. Data shows that women in India have a literacy rate of only 53%. The National Center of Biotechnology Information states that 23% of women in India will stop attending school because they start to menstruate [4]. Unless something is done to assist these young women with the issue of menstruation, the fear is women will continue to remain less educated in India and other Developing Nations because of a lack of education and proper resources to address the issue of menstruation.

Failure to provide education and access to sanitary pads is to deny these young women the basic dignity deserved as a human person. Availability of accessible, antibacterial and affordable sanitary pads is not only a medical, social, and economic issue; it is also an ethical issue facing young women in all Developing Nations. Failure to provide access to safe and affordable sanitary pads violates the basic ethical principles of respect for persons, beneficence, nonmaleficence and justice.

Respect for persons incorporates two ethical convictions: first, that individuals should be treated as autonomous agents; and second, that persons with diminished autonomy are entitled to protection. The principle of respect for persons thus divides into two separate moral requirements: the requirement to acknowledge autonomy and the requirement to protect those with diminished autonomy [38].

Access to education is a fundamental human right implicitly supported by international law, declarations, and State practice. The term “right” is used as an entitlement, a genuine right under international law, where States have a duty to protect and promote those rights for an individual. This basic human right of education has serious implications for humanity. A lack of education not only debilitates the individual but society as a whole. If we believe that education is essential to human life and that millions of people in Developing Nations, especially young women, lack this essential good, then we, who have access to proper education have an ethical responsibility to help correct this situation in order to respect and protect the rights of all people to an education. Those in the world without access to elementary and secondary education are truly vulnerable and have a diminished autonomy. These individuals are not only entitled to protection but we, who have access to proper education, and at times take it for granted, have the ethical responsibility to help provide the means to attain this access. Some developed countries refuse to recognize education as a human right for fear they will be forced to share their resources with those in developing countries. Besides sharing resources there are other ways that developed countries can protect the rights of the most vulnerable. On a smaller scale, individuals can promote and protect the rights of the most vulnerable by using their talents and abilities to seek a solution. Designing a sanitary pad that is sustainable, affordable, antibacterial and adaptable will help young women in Developing Nations receive proper health care, attend school and receive a proper education to advance themselves, their families and society as a whole. In addition, advocating for microfinancing this sanitary pad project by local Indian women’s groups is another way to help the most vulnerable by empowering them financially as well as educationally. This may be a small step forward toward accomplishing a major goal, but it is at least a step forward. To stand by ideally and do nothing to promote and protect this fundamental human right violates the basic dignity and respect of all persons.

Beneficence involves the obligation to prevent and remove harms and to promote the good of the person by minimizing possible harms and maximizing possible benefits. Beneficence includes nonmaleficence, which prohibits the infliction of harm, injury, or death upon others. In medical ethics, this principle has been closely associated with the maxim Primum non nocere: Above all do no harm. Allowing millions of young women to be denied a proper education because they lack the medical and health care resources to stay in school when said resources could be provided violates the principle of beneficence because one is not promoting the good by maximizing benefits and minimizing harms and therefore not acting in the best interest of the most vulnerable people. It also violates the principle of nonmaleficence because it is causing harm and injury not only to these young women who drop out of school but ultimately to their families and society as a whole. Education is a basic human right that belongs to all people. It is not a right that can be denied to women because they lack the adequate health resources to stay in school and excel. Governments have the responsibility to provide an education that fully develops one’s human personality and to strengthen their respect for human rights and fundamental freedom without discrimination. If this right to education is being compromised because young women do not have safe and affordable sanitary pads to stay in school, then it is the ethical responsibility of universities, philanthropists and foundations to help design sanitary pads that meet the basic needs of those without them. This is the foundation of the principle of beneficence, that is, maximizing benefits and minimizing harms. Failure to provide antibacterial,
affordable and accessible sanitary pads to young women in these intolerable situations comes very close to willfully inflicting harm and injury. Medically, we know that unhygienic menstrual practices can lead to urinary tract infections and reproductive tract infections from bacterial or fungal organisms. This puts these women at a higher risk of cervical cancer and infertility. As human beings, we have a moral obligation to do what is good for our fellow human beings. Compromising the basic ethical foundations upon which human rights stand is not only destructive for individuals and particular nations but for the world community as a whole. As human beings, we have an ethical responsibility to ensure that all people are provided their basic human rights. To accomplish this goal would entail advocating for young women in Developing Nations to stay in school and receive a proper education, condemning government policies that fail to address the needs of education for young women, and providing adequate technical assistance in funding and implementing basic sanitary pads that are accessible, antibacterial and affordable. To refuse to help not only fails the test of beneficence, but also may fail the test of nonmaleficence.

Finally, the principle of justice recognizes that each person should be treated fairly and equitably, and be given his or her due. Justice also pertains to distributive justice, which concerns the fair and equitable allocation of resources, benefits and burdens, according to a just standard. If education is a basic human right, and we know that young women are dropping out of school because they do not have sanitary pads and the necessary health education to understand menstruation, then we as citizens of the world have an ethical responsibly to assist them. This can be done on a macro-level by advocating for a proper and equal education for all boys and girls. On a micro-level, universities can assist with the technical development of products like safe sanitary pads that can help alleviate health and cultural issues that lead to young women dropping out of school. This project, which is a collaborative enterprise between two universities and multi-academic disciplines, demonstrates that justice can be attained when challenges are identified, designs are analyzed, and solutions are proposed. If access to education is a basic human right, then every member of the human race has the right to accessible, affordable education in a quantity and quality sufficient to life and basic economic activities. To turn our backs on these young women out of ignorance of the issues that are forcing them to drop out of school is unethical. Ignorance is not an excuse or a defense because it is a well-known fact that education is basic and essential to human existence. To plead ignorance violates the basis of being human. To allow some people in the world access to education and others to be denied because of medical-health care issues is an egregious violation of the principle of justice. Justice dictates that all people should be treated in a similar manner if at all possible. If individuals in developed nations have the means, ability and resources to create a sanitary pad that is antibacterial, accessible, cost-effective and sustainable, then failure to implement this project violates the basic tenet of justice, that is, to treat all people fairly and equitably.

The sanitary pad options designed and developed by the faculty and students of Drexel University and Saint Joseph’s University are not only effective and cost-efficient but through micro-financing they can also be accessible and sustainable. This project can serve as both a paradigm and a challenge to others in the developed world to help make access to education and proper healthcare a reality for those living in developing nations. Failure to acknowledge the fact that millions of young women in the world lack access to education for health care reasons and failure to provide solutions to this crucial life and death issue is ethically irresponsible and morally objectionable.

CONCLUSION
It is clear that the need for action is now. After months of research, and seeing the need firsthand of why young women are dropping out of school in India and other developing nations for health care reasons, the students and faculty at Drexel University and Saint Joseph’s University have come up with a design and implementation strategy for not only improving health care conditions for these young women, but also for helping elevate these vulnerable and marginalized young women out of poverty. Although these sanitary designs alone are unlikely to solve the education crisis, they can certainly become part of a comprehensive public health policy to help restore the fundamental right to education to those who inherently deserve it. Through partnerships and investments in promoting health care initiatives like the sanitary pad project, young women in Developing Nations will receive an education that will not only benefit them as individuals, but will benefit their families and society as a whole.

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Author Information

Peter A. Clark  
Professor/Director-Institute of Clinical Bioethics, Saint Joseph’s University  
Philadelphia, PA

Alphonso D. McClendon  
Associate Professor of Design, Drexel University  
Philadelphia, PA

Ana Maheshwar  
Chief Resident-Internal Medicine, Mercy Catholic Medical Center  
Darby, PA

Thanh My Nguyen  
Graduate Student of Design Research, Drexel University  
Philadelphia, PA

Olivia Nguyen  
Senior Research Fellows-Institute of Clinical Bioethics, Saint Joseph’s University  
Philadelphia, PA

Megan McNamee  
Senior Research Fellows-Institute of Clinical Bioethics, Saint Joseph’s University  
Philadelphia, PA

Christina Gareis  
Senior Research Fellows-Institute of Clinical Bioethics, Saint Joseph’s University  
Philadelphia, PA