

41st WEDC International Conference, Egerton University, Nakuru, Kenya, 2018

**TRANSFORMATION TOWARDS SUSTAINABLE
AND RESILIENT WASH SERVICES**

**Sanitation ‘secrets’ and menstrual hygiene management:
what can perimenopausal women tell us?**

A. Bhakta, J. Fisher & B. J. Reed (UK)

PAPER 3069

An increasingly ageing population brings a rise in the number of perimenopausal women, who commonly experience changes and irregularities in their menstruation, which they wish to conceal from view and keep ‘secret’. The WASH sector has paid attention to the menstrual hygiene management (MHM) needs of adolescent girls, whilst the MHM needs of perimenopausal women are ignored. Using narratives provided by women in Ghana through oral history interviews, participatory mapping and PhotoVoice, and using a vignette method to engage stakeholders, this paper discusses how MHM during the perimenopause is affected by inadequate sanitation provision. Sanitary materials which fail to provide effective menstrual protection also raise related issues of access to sanitation, toilet and bathing infrastructure design, and the need for good solid waste management. The sanitation needs of menstruating perimenopausal women can be addressed through adapting existing hardware and software solutions.

Introduction

Reproductive health is highlighted as a matter of importance through the Sustainable Development Goals (SDGs). Goal 5, ‘to achieve gender equality and empower all women and girls’ has the specific target to ‘ensure universal access to sexual and reproductive health’ (UNDP, 2016). Existing work in the WASH sector relating to this has largely focussed upon menstrual hygiene management (MHM). Much of the MHM literature covers the needs of adolescent schoolgirls (Sommer, 2010; Tegegne and Sisay, 2014; Crofts and Fisher, 2012; Kidney *et al*, 2013; Jewitt and Ryley, 2014), whilst the MHM needs of perimenopausal (PM) women at the end of the reproductive life stage remain ignored. According to the WHO, the perimenopause ‘includes the time immediately prior to the menopause (when the endocrinological, biological and clinical features of the menopause commence) and the first year after menopause’ (Utian, 1999: 284). The menopause is distinct from the perimenopause, and begins one year from the final menstrual period and marks the permanent cessation of menstruation (WHO, 1981).

Women menstruate during the perimenopause and until the menopause. As the global population ages, it is estimated that of the 1.2 billion women projected to be over the age of 50 and therefore likely to be passing or have passed through the perimenopause by 2030, 76% will be living in low-income countries (Hill, 1996). MHM for these PM women therefore warrants greater attention as their number increases. To date, MHM discussions in this context are silent where issues of the perimenopause are concerned.

The MHM needs of perimenopausal women come into sharper focus when explored through the lens of sanitation. Sanitation systems should ideally facilitate discrete MHM as a priority (Sommer *et al*, 2013) in line with known different beliefs and knowledge about menstruation (Van de Walle and Renne, 2001). Sanitation systems need to consider the degree to which spaces in which menstruation is managed are public (i.e. inside the home or in more public spaces such as schools). This is important because MHM is regarded as a secret issue which women and girls hide from each other, and from men and boys (Sommer *et al*, 2013). Thus, the secrecy of menstruation means that MHM seldom influences sanitation design (Sommer and Ackatia-Armah, 2012), compounded by male-dominance in infrastructure investments (van Wijk-Sijbesma, 1998). The MHM needs of PM women provide new perspectives on the requirement to conceal

menstruation from the view of others through effective sanitation, keeping it ‘secret’, even towards the end of women’s reproductive life stages. Drawing upon the narratives of women from doctoral research in Ghana in two low-income communities, La in Accra and Kotei in Kumasi, , this paper raises the importance of MHM during the perimenopause. Gazing through the lens of urban sanitation, it shares women’s voices on attendant sanitation issues specific to the perimenopause, which to date are rarely discussed. This paper also provides potential solutions from a stakeholder perspective to meet the sanitation needs of menstruating perimenopausal women.

‘Menstrual hygiene matters’ for perimenopausal women too

In their manual, *Menstrual Hygiene Matters: a resource for improving menstrual hygiene around the world*, House et al (2012) discuss how effective MHM is important for women and girls’ health, education, dignity, gender equity and rights to WASH. Yet, the perimenopause is not mentioned in the manual, nor in the broader WASH literature. PM women face different changes in their menstruation as they approach menopause, when their periods permanently cease. The perimenopause is marked by irregularity in menstrual periods. This is due to variability in the length of the menstrual cycle, which can vary between 14 and 50 days (Dudley *et al*, 1998) instead of the expected 28-day cycle (Harlow *et al*, 2006). MHM is therefore important for women at more irregular times. Periods may be missed altogether for several months and then start again abruptly.

The importance of MHM for PM women is illustrated by the changes in the flow of menstruation, which can be heavier during the perimenopause. MHM is particularly important for women with menorrhagia, when there is very heavy menstrual bleeding, and a loss of more than 80ml of blood per menstrual cycle (Hallberg *et al*, 1966). Oestrogen levels produced by the ovaries are significantly higher than progesterone levels, which do not change, and this causes the wall of the uterus to continue to thicken over longer periods of time. Perimenopausal women can therefore face significantly heavier and prolonged bleeding (Duckitt, 2010), than they typically would do before the perimenopause. MHM techniques for perimenopausal women therefore need to be able to absorb particularly high volumes of blood.

Whilst menstrual changes during the perimenopause are recorded in the literature, these issues have not been discussed in a WASH context. In a Ghanaian context, menopause and menstruation are considered as matters for women, and therefore are not discussed publicly in this patriarchal society. Young girls are often shocked by the onset of menarche, as beyond limited discussion with their peers, they know little about menstruation before it begins (Bhakta *et al*, 2016). Silences around menstruation extend to the perimenopause, with women keeping their experiences to themselves and not discussing them with others, similar to young girls knowing little about these changes until they occur. These silences are reinforced by taboos, which mean that menstruating women should not: cross a threshold into a house, cook, be in the company of men in particular, but other women and children too, and participate in social activities which involve men (Bhakta *et al*, 2016). MHM for PM women has been ignored due to taboos around these issues, along with the WASH needs of PM women overall (Bhakta *et al*, 2014). Looking at MHM for PM women through sanitation use highlights why it is important to pay attention to these needs.

Methodology and case study

The methodology for this study was grounded in a feminist approach, which was the most appropriate means to capture the hidden MHM needs of PM women (Bhakta *et al*, 2014; Bhakta *et al*, 2016; Bhakta *et al*, 2017). Traditional, male dominated research approaches silence women’s voices (Chafetz, 1998; Brisolara, 2014). Women are active participants in feminist research, which involves researching *with* women rather than *on* women, to socially construct knowledge, social change and empowerment. In line with a feminist approach, participatory approaches, which place the first last (Chambers, 1997) were adopted. The MHM experiences of PM women were predominantly captured through a feminist oral history approach. Feminist oral history incorporates the use of semi-structured interviews to capture women’s narratives and to validate their lives and experiences, which can be obscured by social, economic and political discourses (Sangster, 1994). During the fourteen interviews conducted across the two communities, women narrated their experiences of menstruation during the perimenopause, provided detail about their MHM techniques, particularly the materials used for sanitary protection and how often they changed, and discussed the extent to which sanitation could meet their MHM needs.

Insight into MHM techniques and the washing of materials were captured from two participatory mapping discussions in each community. Participatory mapping helps researchers to ‘get things right’ (Chambers,

1997: 145) by including socially excluded individuals in mapping groups. Women of Ga ethnicity in La were more open to discussing MHM during the perimenopause in a group during the mapping process. In Kotei however, a group of older Twi menopausal women felt it was inappropriate to talk about issues of menstruation in front of each other, due to local taboos.

Participatory photography, or PhotoVoice allows individuals to raise issues which are directly affecting them through photographs (Blackman and Fairey, 2014). Three women in Kotei and two women in La were provided with 'point and shoot' digital cameras to participate in PhotoVoice exercises, which captured infrastructural issues that indirectly influence the MHM needs of PM women. Images illustrated general issues in the community regarding sanitation, focussing upon inadequate waste, toilet and drainage provision. Their images did not illustrate specific MHM issues for perimenopausal women but were reflective of sanitation issues faced by the community, across different life stages. Women did not say why MHM was not captured in the photographs. Photographs of MHM-related sanitation issues may have been difficult to take if women were not menstruating at the time of the exercise and therefore they may not have been able to show how they interact with sanitation specifically for MHM, or they were reacting to existing taboos around depicting menstrual blood.

The communities in this study, La, in the La Dade-Kotopon Municipal Assembly (LaDMA) area of Accra, and Kotei, in Oforikrom Sub-Metro (OSM) in Kumasi both have inadequate sanitation provision implemented by the local municipal assembly and sub-metro respectively. The proportion of residents who use household toilet facilities in LaDMA was 50.8% in 2013. 49.2% used public toilets. In terms of sanitation type, 43% of LaDMA used WCs and 4.5% relied upon a KVIP (LaDMA, 2013). The community of La has a large toilet block estimated to be 30-35 years old, with 48 cubicles, 24 of which are for women. Whilst the block has WCs and a supportive water storage tank, the WCs warrant the use of a pour flush technique as they do not function well. Toilet waste is carried into a manhole by a pipe and is emptied monthly according to use. Due to poor low energy lighting, candles are used. A smaller toilet block has no doors upon the cubicles for the seven adult- and children-sized toilets, operating by pour flush. Newspaper is used instead of toilet paper and collected in baskets for incineration. Ventilation is provided by open windows and a bowl of soapy water is provided for hand washing. Subject to payment, waste is collected door-to-door by hand-pulled carts, after it is collected by households into white bags and placed into dustbins. Trucks also collect waste and take it to a dumpsite 40 minutes away from La. Menstrual hygiene waste, which women and girls do not wish others to see, can be disposed of at home. In Kotei, whose services come under the jurisdiction of OSM, 47% of the community relied upon the three community based public toilets in 2012. 35% of household latrines were WCs and 18% were pit latrines (Leathes, 2012). Women in this study mostly used a 20 cubicle WC toilet facility constructed by USAID in partnership with WSUP, designed to meet the needs of women, the disabled and the elderly (Leathes, 2012). A septic tank is connected to the toilet and is emptied every three months. Attempts have been made to create a community management committee for the block (Leathes, 2012). Solid waste services are limited in Kotei. Many residents rely on a community dumpsite and do not have adequate disposal facilities in toilets. A waste collection service is not provided. Disposing menstrual waste away from the view of others, particularly men, is therefore challenging for women and girls.

Stakeholders at LaDMA and OSM were engaged to identify potential solutions to meet the sanitation needs of PM women for MHM using the vignette method. This involves 'presenting respondents with one or more scenarios and then asking them how they would respond when confronted with the circumstances of that scenario' (Bryman 2016: 259). Vignettes involve the formation of fictional situations based upon real life events, and can be presented as case studies in a written form or spoken as stories. This method was used to elicit views from people providing a service (Robson and McCartan, 2016). Three vignettes were used to present the MHM experiences of PM women to stakeholders, using standardised case studies for them to respond to, with solutions for the provision of adequate sanitation to meet PM women's MHM needs. The vignettes were formed using the data collected from PM and menopausal women in La and Kotei, detailing a range of symptoms experienced, WASH practices, and infrastructural challenges faced. Each vignette had different symptoms and issues. Potential solutions to these, were printed onto individual slips of paper to choose from and presented to the stakeholders, along with post-it notes to write down solutions of their own. Stakeholders were asked to read each vignette, and were asked to respond to the following question: "Based upon the case study presented in front of you, which of the solutions on the slips of paper would you fund from a hypothetical fixed budget for your organisation to meet this woman's WASH needs, and why?" All discussions were conducted in English, recorded on a digital recorder, and later transcribed.

MHM techniques during the perimenopause

MHM techniques changed during the perimenopause compared to the reproductive life stage, particularly for women with heavy blood flows. Materials used for MHM were largely determined by their affordability and familiarity; some PM women or their relatives bought products which they could afford, others adapted traditional techniques which they were previously using to meet their MHM needs during perimenopause. Cloths were still used by PM women, but for those with heavy menstrual flow, they did not effectively absorb the high volumes of blood lost when used as a single layer. Larger pieces of cloth were folded to make a thicker material. Some PM women supplemented the use of a cloth with cotton wool to provide greater levels of absorbency. Other women bought commercial sanitary pads, either using them alone or layering them on top of their existing menstrual cloths for extra protection. MHM can even extend to the use of nappies or diapers during the perimenopause, when sanitary pads and cloths do not suffice to protect from staining during heavy periods. The ineffectiveness of MHM techniques also highlighted how sanitation does not cater for the MHM needs of PM women.

What secrets can perimenopausal women tell us about MHM and sanitation?

Maintaining good hygiene and cleanliness during menstruation is as important to PM women as for women in other life stages. PM women who are experiencing heavy menstrual periods in contexts such as Ghana, where menstruation is taboo, are especially concerned with hiding or concealing heavy menstrual blood flow. Women do not want other people (women and more importantly men) to know that they are menstruating relatively more than they would expect to normally. Not only is the perimenopause seldom discussed in public, but the symptoms of the perimenopause are not visible. PM women are concerned about ensuring that they do not leave a mark of their symptoms within the sanitation spaces that they use, and the surrounding environment. The study identified four aspects of sanitation which impact upon the MHM experiences of PM women: access to public toilets, toilet design, solid waste infrastructure and services, and bathing facilities.

Access to toilets on a 24-hour basis was raised as a critical issue. The irregularity of menstrual periods made it challenging for PM women to know what day or time their periods would begin, instead of their expected date. PM women therefore required access to toilets at any time of the day and on any day of the month for MHM. Experiencing heavy menstrual flow warranted more frequent use of the toilet to change materials more often, because they would be very soiled in a short space of time. Needing to access toilets regularly made travelling beyond the community challenging for perimenopausal women, because they felt that access to adequate sanitation could not be guaranteed. Access to toilets was also compromised when they were closed due to lack of water. Provision of toilets at work was important for PM women with irregular periods to maintain their personal hygiene and to continue to work and generate income.

Toilets were ill-designed to meet the sanitation needs of heavily menstruating PM women. Constant, uncontrollable and heavy blood flow whilst using the community toilets led to latrine slabs being significantly stained. PM women were conscious of not exposing the fact that they were menstruating heavily in public facilities. Staining slabs in public toilets was embarrassing for them. If water was available within the toilets, efforts would be made to wash the blood stains away from the latrine or to cover them up with a tissue.

Inadequate solid waste management services compromised effective disposal of menstrual hygiene materials. PM women wished to conceal their heavily soiled cloths and pads from the view of others, making them a form of 'secret waste'. In Kotei for instance, inadequate provision of dustbins either in the community toilets or at a household level led one woman to carry her soiled materials from the community toilet, to the house where she was able to wrap them into a bag for disposal at the dump site. This practice raised issues of contamination. In La, whilst a waste collection service was provided at household level, and soiled materials were disposed of at home, high unemployment levels among the sample meant that paying for this could be a challenge, thereby compromising discrete disposal and waste collection.

Bathing facilities were also sites where MHM issues for PM women were highlighted. Lack of dustbins or containers for waste disposal near to or within bath houses made effective solid waste management difficult. Women who experienced heavy periods had to carry their waste away from the bath house to the home where it could be wrapped and disposed of. Soiled menstrual cloths were also washed in bath houses, requiring extra water than usual to effectively wash blood away from the floor, which was easily stained. When washing cloths in a bowl, care was taken to cover up the blood stains by ensuring that the soapy foam

from the water floated on top of the bowl. Menstrual cloths were then dried on a washing line within the home in a space where others could not see them.

Providing effective sanitation for MHM: responding to PM women

Stakeholders at LaDMA and OSM provided suggestions of how the sanitation needs of PM women for MHM can be met through appropriate infrastructure, and how best to raise awareness and understanding of these issues for PM women, the community and WASH professionals alike. The solutions to meeting PM women's MHM needs involve software approaches which are widely known in the sector and are already applied for other groups. Hardware solutions for sanitation are also in existence. To cater for MHM needs for PM women through sanitation however, existing solutions need to be adapted.

Meeting the sanitation needs of menstruating PM women

Meeting the sanitation needs of PM women to enable them to effectively manage their menses when they are irregular in timing and in flow requires a mixture of software and hardware solutions to be implemented.

Software:

- Health and WASH professionals paying greater attention to PM women enables women to be more aware of the menstruation issues they are facing and that they are a normal part of this lifestage, and identify relevant health issues
- Hygiene education should promote good MHM practices for irregular menstrual patterns
- Health worker advice on menstruation during PM can help to identify underlying health problems

Hardware:

- 24-hour water supply allows PM women to keep themselves clean, to wash MHM materials and clothes, and infrastructure stained with menstrual blood during heavy periods;
- Effective waste water disposal and covered drainage help to conceal heavily blood-stained waste water from public view, and reduce the risk of contamination
- Soakaways located near to bath houses and laundry facilities provides the means to remove the higher quantities of blood lost during periods by PM women from the water systems
- Designated laundry facilities provide privacy for women to wash and dry heavily soiled menstrual cloths and clothing
- Gender sensitive design in public community toilets should incorporate a changing area in which women can change and wash materials privately
- Sanitary disposal bins in public toilets and appropriate bins at a household level provide the means of discrete disposal for heavily soiled materials
- Waste collection services which are affordable and accessible for all facilitate hygienic and discrete disposal of materials

Conclusion

An ageing population and the post-2015 SDG agenda raises the need to pay greater attention to the increasing number of perimenopausal women, particularly in the global South. Existing work on MHM in the WASH sector focuses predominantly upon the needs of adolescent girls at menarche, while the MHM needs of PM women with erratic and unpredictable menstrual patterns are ignored. These needs become most apparent when examined from a sanitation perspective. PM women want to conceal their irregular menstrual patterns from the view of others due to local taboos surrounding menstruation and the menopause. Inadequate access to well-designed sanitation infrastructure, sanitation services, individual finance, and greater demand for water makes the meeting of these needs and the concealment of menstrual issues challenging for PM women. Meeting the sanitation needs of menstruating PM women requires the adaptation of existing hardware and software solutions to facilitate effective MHM.

Acknowledgements

The authors would like to extend thanks to all of the women who kindly shared their experiences for this research, and to stakeholders for their thoughtful feedback on the results. We also thank Loughborough University for funding this research. Thanks to Gloria Annan, Benjamin Lartey, Kate Simpson, Harold

Esseku, Yvonne Esseku, Kwabena Nyarko, Nehemiah Samwini and Mandy Sears for their support in the field.

References

- BHAKTA, Amita, REED, Brian and FISHER, Julie. 2017. "Cleansing in hidden spaces: the bathing needs of perimenopausal women" in Shaw, Rod (ed.) *Proceedings of the 40th WEDC Conference*, WEDC: Loughborough University, UK
- BHAKTA, Amita, ANNAN, Gloria, ESSEKU, Yvonne, ESSEKU, Harold, FISHER, Julie, LARTEY, Benjamin and REED, Brian. 2016. "Finding hidden knowledge in WASH: effective methods for exploring the needs of perimenopausal women in Ghana" in Shaw, Rod (ed.) *Proceedings of the 39th WEDC Conference*, WEDC: Loughborough University, UK
- BHAKTA, Amita, FISHER, Julie, and REED, Brian. 2014. "WASH for the perimenopause in low-income countries: changing women, concealed knowledge?" in Shaw, Rod (ed.) *Proceedings of the 37th WEDC Conference*, WEDC: Loughborough University, UK
- BRISOLARA, Sharon. 2014. "Feminist theory: its domains and applications" in Brisolara, Sharon, Seigart, Denise and SenGupta, Saumitra (eds.) *Feminist Evaluation and Research: Theory and Practice* The Guilford Press: New York pp.3-31
- BLACKMAN, A., and FAIREY, T. 2014. *The PhotoVoice Manual: A guide to designing and running participatory photography projects* PhotoVoice Publications: London
- CHAFETZ, J.S. 1998. *Feminist theory and sociology: underutilized contributions for mainstream theory* Annual Review of Sociology Vol 23 No 1 pp.97-120
- CHAMBERS, Robert 1997 *Whose Reality Counts? Putting the First Last* ITDG Publishing: Burton-on-Dunsmore
- CROFTS, T., and FISHER, J. 2012. *Menstrual hygiene in Ugandan schools: an investigation of low-cost sanitary pads*. Journal of Water, Sanitation and Hygiene for Development, Vol.2 No.1, pp. 50 - 58.
- DUCKITT, K. 2010. *Managing perimenopausal menorrhagia* Maturitas Vol 66 No 3 pp.251-6
- DUDLEY, E.C., HOPPER, J.L., TAFTE, J. GUTHRIE, J.R., BURGER, H.G., and DENNERSTEIN, L. 1998. *Using longitudinal data to define the perimenopause by menstrual cycle characteristics* Climacteric Vol 1 No 1 pp.18-25
- HALLBERG, L., HÖGDAHL, AM., NILSSON, L., and RYBO G. 1966. *Menstrual blood loss—a population study. Variation at different ages and attempts to define normality* Acta Obstetrica et Gynecologica Scandinavica Vol 45 No 3 pp. 320–51
- HARLOW, S.D., CAIN, K., CRAWFORD, S., DENNERSTEIN, L., LITTLE, R., MITCHELL, E.S., NAN, B., RANDOLPH, J.F., TAFTE, J., and YOSEF, M. 2006 *Evaluation of four proposed bleeding criteria for the onset of late menopausal transition* Journal of Clinical Endocrinology & Metabolism Vol 91 No 9 pp. 3432-3438
- HILL, K. 1996 *The demography of menopause* Maturitas Vol 23, No 2 pp.113-27
- HOUSE, S., MAHON T. and CAVILL, S. 2012 *Menstrual hygiene matters. A resource for improving menstrual hygiene around the world* London: WaterAid
- JEWITT, S., and RYLEY, H., (2014) *It's a girl thing: Menstruation, school attendance, spatial mobility and wider gender inequalities in Kenya* Geoforum Vol 56 No 1 pp.137-147
- KIDNEY, Maria. 2013. "Girls for Girls Programme, Kenya" in Shaw, Rod (ed.) *Proceedings of the 36th WEDC Conference*, Loughborough University, UK: WEDC
- LADMA 2013. *District Environmental Sanitation Strategy and Action Plan* LaDMA: Accra
- LEATHES, Bill 2012 *Topic brief: Delegated management of water and sanitation services in urban areas: experiences from Kumasi, Ghana* Available online at: <http://www.wsup.com/resource/delegated-management-of-water-and-sanitation-services-in-urban-areas-experiences-from-kumasi-ghana/> [Accessed: 20/05/2016]
- SANGSTER, Joan. 1994. *Telling Our Stories: Feminist Debates and the Use of Oral History* Women's History Review Vol 3 No 1 pp, 5-28
- SOMMER, M. 2010., *Putting menstrual hygiene management onto the school water and sanitation agenda* Waterlines 29 No 4 pp. 268-278
- SOMMER, M., and ACKATIA-ARMAH, N. 2012. *The Gendered Nature of Schooling in Ghana: Hurdles to Girls Menstrual Management in School* JeNdA Vol 20

- SOMMER, M., KJLELLÉN, M., and PENSULO, C. 2013. *Girls' and women's unmet needs for menstrual hygiene management (MHM): the interactions between MHM and sanitation systems in low-income countries* Journal of Water, Sanitation and Hygiene for Development Vol 3 No 3 pp. 283-297
- TEGEGNE, T and SISAY, M. 2014. *Menstrual hygiene management and school absenteeism among female adolescent students in Northeast Ethiopia* BioMedCentral Public Health Vol 14 No 1148
- UTIAN, W.H. 1999 *The International Menopause Society menopause-related terminology definitions* Climacteric Vol 2, No 4 pp.284-286
- UNDP 2016 *UNDP support to the implementation of Sustainable Development Goal 6: Sustainable management of water and sanitation* United Nations Development Programme: New York
- VAN DE WALLE, E., and RENNE, F., 2001. *Regulating Menstruation: Beliefs, Practices, Interpretations* University of Chicago Press: Chicago
- VAN WIJK-SIJBESMA, C. 1998. *Gender in Water Resources Management, Water Supply and Sanitation: Roles and Realities Revisited* International Water and Sanitation Centre: The Hague
- WHO 1981 *Research on the menopause: Report of a WHO Scientific Group* WHO: Geneva
-

Contact details

Amita Bhakta is a PhD student at WEDC researching the WASH needs of perimenopausal women, with particular interests in gender, MHM and oral history. Dr Julie Fisher is a lecturer at WEDC with particular interests in gender, dissemination, knowledge management and history. Brian Reed is also a lecturer on a variety of topics, with a specific interest in capacity building.

Amita Bhakta/Julie Fisher/Brian Reed
WEDC, Loughborough University
Tel: +44 (0)1509 222 393/+44 (0)1509 228 307
Email: A.N.Bhakta@lboro.ac.uk J.Fisher1@lboro.ac.uk
B.J.Reed@lboro.ac.uk
www: www.wedc.lboro.ac.uk
