

Supplementary Materials 2: Revalidation of the original MPNS-36 in Bangladesh (Khulna)

Dimensionality

Table 1 presents item responses, and factor loadings for confirmatory factor analysis (CFA) undertaken to test the performance of the original MPNS-36 factor structure in our *Bangla* version of the measure in Khulna, Bangladesh. The original MPNS-36 factor structure showed strong performance. Despite only 79 cases will full data for items related to changing menstrual materials at school, the original 4-factor structure for participants disposing of materials performed well (CFI=0.924, TLI=0.927, RMSEA=0.075, 90%CI=0.060-0.090). Nearly all factor loadings exceeded 0.5, with poorer fitting items including items related to storing menstrual materials (MPN10), concerns materials would move from place (MPN6) and MPN8 and MPN9 capturing concerns about transporting materials; these items have historically exhibited challenges as they are relevant across locations (not only at home or at school). When removing the items related to changing menstrual materials at schools, relative fit statistics indicated a poorer relative fit for the 4-factor model (CFI=0.886, TLI=0.872), but the model still achieved acceptable absolute fit (RMSEA=0.067, 90%CI 0.058-0.067). Consistent with past studies, the items capturing experiences of washing and drying absorbents showed strong fit with a two-factor model, and performed well when assessed alongside the 4-factors for those changing in school (see Table 1 below).

Table 1. Proportion of participant responses to the full MPNS-36 questions, and confirmatory factor analysis for the original measure in *Bangla*.

| No. | Item | Responses % (n=313) | | | | | CFA Complete cases excl. reuse | CFA Excl. changing at school | CFA Reusables (excl. school changing) |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------|------------------|------------------|--------|---------------|--------------------------------|------------------------------|---------------------------------------|
| | | Never | Some of the time | Most of the time | Always | Missing (n) % | | | |
| Material and home environment needs | | | | | | | | | |
| 1 | Were your menstrual materials comfortable? | 5.11 | 18.21 | 22.36 | 54.31 | | 0.517 | 0.479 | 0.597 |
| 2 | Did you have enough of your menstrual materials to change them as often as you wanted to? | 2.56 | 15.97 | 21.09 | 60.38 | | 0.649 | 0.562 | 0.466 |
| 3 | Were you satisfied with the cleanliness of your menstrual materials? | 1.92 | 11.82 | 15.97 | 70.29 | | 0.680 | 0.706 | 0.827 |
| 4 | Could you get more of your menstrual materials when you needed to? | 10.54 | 20.45 | 45.97 | 53.04 | | 0.653 | 0.483 | 0.380 |
| 10 | Did you feel comfortable storing [keeping] your leftover or cleaned menstrual materials until your next period? | 35.90 | 18.59 | 17.63 | 27.88 | (1) 0.32 | 0.190 | 0.066 | 0.536 |

| | | | | | | | | |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------|-------|-------|-------|----------|-------|-------|
| 11 | Were you able to wash your hands when you wanted to? | 1.60 | 7.67 | 11.18 | 79.55 | 0.783 | 0.576 | 0.753 |
| 12 | Were you able to immediately dispose of your used menstrual materials? (n=267) | 9.74 | 18.35 | 21.35 | 50.56 | 0.592 | 0.527 | - |
| 13 | Were you able to dispose of your used materials in the way that you wanted to? (n=267) | 9.4 | 19.55 | 21.05 | 50.00 | (1) 0.37 | 0.585 | 0.571 |
| 16 | Home - Were you able to change your menstrual materials when you wanted to? | 4.47 | 15.97 | 18.53 | 61.02 | 0.614 | 0.509 | 0.466 |
| 17 | Home - Were you satisfied with the place you used to change your menstrual materials? | 3.19 | 9.27 | 15.65 | 71.88 | 0.627 | 0.730 | 0.737 |
| 18 | Home -Did you have a clean place to change your menstrual materials? | 0.32 | 6.07 | 15.34 | 78.27 | 0.966 | 0.940 | 0.908 |
| Material reliability concerns | | | | | | | | |
| 5 | Were you worried that your menstrual materials would allow blood to pass through to your outer garments? | 27.8 | 52.08 | 15.34 | 4.79 | 0.546 | 0.756 | 0.687 |
| 6 | Were you worried that your menstrual materials would move from place while you were wearing them? | 26.2 | 52.08 | 15.97 | 5.75 | 0.333 | 0.693 | 0.751 |
| 7 | Were you worried about how you would get more of your menstrual material if you ran out? | 68.69 | 23.32 | 6.71 | 1.28 | 1.066 | 0.759 | 0.815 |
| Change and disposal insecurity | | | | | | | | |
| 14 | Were you worried about where to dispose of your used menstrual materials? (n=267) | 59.93 | 28.84 | 7.12 | 4.12 | 0.724 | 0.753 | - |
| 15 | Were you concerned that others would see your used menstrual materials in the place you disposed of them? (n=267) | 46.82 | 35.21 | 13.11 | 4.87 | 0.721 | 0.754 | - |
| 19 | Home - Were you worried that you would not be able to change your menstrual materials when you needed to? | 58.15 | 27.8 | 6.07 | 7.99 | 0.536 | 0.455 | 0.433 |
| 20 | Home - Were you worried that someone would see you while you were changing your menstrual materials? | 68.69 | 22.68 | 6.39 | 2.24 | 0.815 | 0.801 | 0.867 |

| | | | | | | | | | |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|-------|-----------|-------|-------|--------|
| 21 | Home - Were you worried that someone would harm you while I you were changing your menstrual materials? | 82.11 | 14.38 | 3.19 | 0.32 | | 0.923 | 0.915 | 0.710 |
| 22 | Home - Were you worried that something else would harm you while you were changing your menstrual materials (e.g., animals, insects, unsafe structure) | 73.08 | 20.83 | 4.81 | 1.28 | (1) 0.32 | 0.826 | 0.677 | 0.868 |
| 26 | School - Were you worried that you would not be able to change your menstrual materials when you needed to? (n=287) | 53.58 | 31.7 | 9.06 | 5.66 | (22) 7.67 | 0.749 | 0.588 | 0.745 |
| 27 | School - Were you worried that someone would see you while you were changing your menstrual materials? (n=87) | 52.87 | 31.03 | 13.79 | 2.3 | | 0.752 | - | - |
| 28 | School - Were you worried that someone would harm you while you were changing your menstrual materials? (n=87) | 68.97 | 20.69 | 8.05 | 2.3 | | 0.811 | - | - |
| Transport and school environment needs | | | | | | | | | |
| 8 | Did you feel comfortable carrying spare menstrual materials with you outside your home? | 45.66 | 24.12 | 11.58 | 18.65 | (2) 0.64 | 0.381 | 0.668 | 0.532 |
| 9 | Did you feel comfortable carrying menstrual materials to the place where you changed them? | 41.94 | 24.84 | 16.13 | 17.10 | (3) 0.96 | 0.436 | 0.498 | 1.088 |
| 23 | School - Were you able to change your menstrual materials when you wanted to? (n=287) | 56.51 | 22.3 | 8.92 | 12.27 | (18) 6.27 | 0.645 | 0.745 | 0.039 |
| 24 | School - Were you satisfied with the places available at your school for changing your menstrual materials? (n=287) <i>*Note this question was modified from the original MPNS to be more inclusive of those not changing at school.</i> | 50.19 | 21.07 | 16.09 | 12.64 | (26) 9.06 | 0.827 | 0.641 | -0.074 |
| 25 | School - Did you have a clean place to change your menstrual materials? (n=87) | 14.94 | 43.68 | 22.99 | 18.39 | | 0.876 | - | - |
| Reuse needs (n=70) | | | | | | | | | |
| 29 | Did you have enough water to soak or wash your menstrual materials? | 2.99 | 2.99 | 14.93 | 79.10 | (3) 4.29 | | .747 | 0.773 |

| | | | | | | | | |
|------------------|-----------------------------------------------------------------------------------------------------------|---------------------|-------|---------------------|-------|---------------------|------|---------------------|
| 30 | Did you have access to a basin or bucket to soak or wash your menstrual materials whenever you needed it? | 4.41 | 1.47 | 13.24 | 80.88 | (2) 2.89 | .972 | 0.950 |
| 31 | Were you able to wash your menstrual materials whenever you wanted to? | 2.94 | 5.88 | 16.18 | 75.00 | (2) 2.86 | .963 | 0.979 |
| 32 | Did you have enough soap to wash your menstrual materials? | 2.94 | 1.47 | 19.12 | 76.47 | (2) 2.86 | .883 | 0.894 |
| 33 | Were you able to dry your materials when you wanted to? | 4.35 | 18.84 | 15.94 | 60.87 | (1) 1.43 | .617 | 0.697 |
| Reuse insecurity | | | | | | | | |
| 34 | Were you worried that someone would see you while I you were washing your menstrual materials? | 54.41 | 27.94 | 10.29 | 7.35 | (2) 2.86 | .807 | 0.894 |
| 35 | Were you worried that your menstrual materials would not be dry when you needed them? | 54.41 | 32.29 | 10.29 | 2.94 | (2) 2.86 | .942 | 0.980 |
| 36 | Were you worried that others would see your menstrual materials while they were drying? | 42.65 | 36.76 | 14.71 | 5.88 | (2) 2.86 | .797 | 0.858 |
| | | (n=79) | | (n=218) | | (n=67) | | (n=50) |
| CFI (scaled) | | 0.924 | | 0.886 | | 0.987 | | 0.922 |
| TLI (scaled) | | 0.927 | | 0.872 | | 0.980 | | 0.913 |
| RMSEA (90% CI) | | 0.075 (0.060-0.090) | | 0.067 (0.058-0.067) | | 0.112 (0.049-0.170) | | 0.067 (0.041-0.088) |

MPNS-36 internal consistency and validity in the Khulna pilot

The full original sub-scale exhibited strong internal consistency (Cronbach’s $\alpha = 0.86$), with sub-scales ranging from 0.64 (for the 3-item material reliability concerns sub-scale) to 0.81 for items capturing insecurities about changing and disposal. Consistent with the cognitive interviews and further study information from the pilot sample, girls’ experiences of managing menstruation at school were rated much more poorly than experiences at home, with the transport and school environment needs sub-scale mean only 0.96, compared to a mean of 2.30 capturing girls’ satisfaction with materials and menstrual management at home (presented in Table 2 below). We found hypothesised relationships between the MPNS-36 and measures of mental health. While the MPNS total score was not associated with absenteeism during the last menstrual period, it was associated with 2.72 increased odds of not experiencing difficulties participating in class due to menstruation. The MPNS-36 was not associated with confidence managing menstruation at home, but sub-scales capturing satisfaction with materials, and with the school environment were positively associated with confidence managing menstruation at school. Findings suggest the original MPNS-36 shows good internal consistency and validity in the Khulna pilot sample.

Table 2. MPNS-36 total and sub-scale scores, internal consistency and associations with hypothesised correlates in the Khulna pilot data

| | Mean | SD | α | α_{ordinal} | DASS* r (p-value) | Did not miss school due to last period OR (95%CI) | Did not experience difficulty participating in class due to last period OR (95%CI) | Very confident managing menstruation at home OR (95%CI) | Confident managing menstruation at school OR (95%CI) |
|---------------------------------------------------|------|------|----------|---------------------------|----------------------|------------------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------|
| Material and home environment needs (n=313) | 2.30 | 0.48 | 0.73 | 0.83 | -0.29 (p<.001) | 1.46 (0.91-2.35) | 1.77 (1.03-3.03) | 1.06 (0.64-1.77) | 3.63 (2.12-6.20) |
| Change and disposal Insecurity (n=313) | 2.50 | 0.49 | 0.81 | 0.90 | -0.32 (p<.001) | 1.12 (0.71-1.77) | 1.90 (1.56-3.13) | 1.12 (0.68-1.85) | 1.26 (0.78-2.02) |
| Material reliability concerns (n=313) | 2.20 | 0.58 | 0.64 | 0.71 | -0.29 (p<.001) | 1.19 (0.81-1.76) | 2.00 (1.31-3.08) | 1.23 (0.80-1.87) | 1.38 (0.92-2.06) |
| Transport and school environment needs (n=286) | 0.96 | 0.74 | 0.65 | 0.74 | 0.07 (p=.430) | 0.92 (0.66-1.26) | 1.31 (0.94-1.80) | 1.22 (0.87-1.67) | 1.79 (1.23-2.59) |
| Reuse needs (n=67) | 2.61 | 0.56 | 0.81 | - | - n=33 | - | - | - | - |
| Reuse insecurity (n=67) | 2.28 | 0.75 | 0.82 | - | - n=33 | - | - | - | - |
| Total score | 2.16 | 0.37 | 0.86 | 0.92 | -0.34 (p<.001) | 1.22 (0.66-2.26) | 2.72 (1.37-2.39) | 1.13 (0.58-2.16) | 3.94 (2.01-7.73) |

*Note: Only half of the sample was administered the DASS, associations presented here are for this half of the sample (n=164 of 313 menstruating girls).