Review

Overview of methods used in cross-cultural comparisons of menopausal symptoms and their determinants: Guidelines for Strengthening the Reporting of Menopause and Aging (STROMA) Studies

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Abbreviations:

AJMWHS, Australian/Japanese Midlife Women's Health Study;
DAMeS, Decisions At Menopause Study;
FMEG, Four Major Ethnic Groups;
HWHS, Hilo Women's Health Survey;
MAHWIS, Mid-Aged Health in Women from the Indian Subcontinent;
POAS, Penn Ovarian Aging Study;
SWAN, Study of Women's Health Across the Nation;
WHiMNS, Women's Health in Midlife National Study;
WISHeS, Women's International Study of Health and Sexuality;

Contents

FOR CARLA: By cutting the above text, we can save about 1200 words. I tried to put relevant data into Table 1 (MKM redo) – see Excel file. We could also put more detail about sampling and recruitment from the text into the table. See what you think. At present, we are way over the word limit. Also each column of Table 1 has several data values, and I thought it might be clearer if we turned the table around (studies on top) and variables down the left side – so that values for each variable can be clearly compared. If we cut 2.1-2.9 and put all relevant information in Table 1, we can save about 1200 words. (see Table1MKMredo worksheet in Overview Excel file). If we keep it, we should be consistent with data included – some descriptions have N and age ranges, and others do not.

Abstract

Methodological differences between studies of cross-cultural menopausal symptoms limit attempts at comparison or systematic review. The purpose of this paper is to provide an overview of methods used in cross-cultural studies of menopausal symptoms and to make general recommendations for increasing methodological rigor in the field. This article serves as an introduction to four separate reviews of the findings and methods used in cross-cultural studies of vasomotor, psychological, somatic, and sexual symptoms at midlife.

Medline, PsycINFO, CINAHL and Google Scholar were searched for English-language articles published from 2005-2010 using the terms "cross cultural comparison" and "menopause." From the results of these searches, 8 studies fully met the following criteria: they included more than one culture (country or ethnic) group and asked about actual symptom experience (not symptom expectation or symptoms attributed to menopause). This review demonstrates considerable variation across studies in age ranges, symptom lists, reference period for symptom recall, variables included in multivariate analyses, and the measurement of factors (e.g., menopausal status and hormonal factors, demographic, anthropometric, mental/physical health, and lifestyle measures) that influence vasomotor, psychological, somatic and sexual symptoms.

Our recommendations regarding age range, symptom lists, reference/recall periods, and measurement of menopausal status are given here. Recommendations specific to the cross-cultural study of vasomotor, psychological, somatic, and sexual symptoms are found in the four reviews that follow this introduction.

Keywords:
Menopause
Cross cultural comparison
Methodology
Symptom reporting

1. Introduction

This is the introduction to a series of reviews, the purpose of which is to examine: (a) the methods used in cross-cultural comparisons of vasomotor [1], psychological [2], somatic [3], and sexual [4] symptoms at midlife; (b) the frequency of symptoms across culture/ethnic groups; and (c) the determinants of these symptoms and how they were measured. Finally we propose guidelines for Strengthening the Reporting of Menopause and Aging (STROMA) Studies, a checklist of items that should be included in all reports of observational studies of menopause to enable cross-cultural and cross-population comparisons. Although several recent cross-cultural reviews of menopausal symptoms have been published [5, 6], conclusions and interpretations are constrained by methodological limitations that make rigorous comparisons across studies difficult. Symptom prevalence rates show considerable cross-cultural variation [5, 6], but it is unclear how such variation should be interpreted given methodological differences in variables such as recall period, population composition (age and menopausal status), and outcome measures (frequency, severity, and/or bothersomeness,). Until individual studies use consistent, comparable measures, cross-cultural comparisons across studies will be severely limited.

If our aim is cross-cultural comparisons of menopausal symptoms, how do we measure culture? Are variables such as country of residence [7], or ethnicity [8, 9] good proxy measures for culture? Do these differences disappear if relevant aspects of culture such as sociodemographics, health, lifestyle, and social circumstances [10], or education, language and acculturation [8] are controlled for? The Study of Women Across the Nation (SWAN) has identified significant cultural/ethnic differences in rates of smoking, exposure to passive smoke, alcohol intake, phytoestrogen consumption, BMI and weight, physical activity, rates of hysterectomy, and age at menopause – which may partly explain the differences in symptom

reporting [8], and indeed most ethnic differences in health-related quality of life disappeared after controlling for confounders and covariates [10]. In contrast, in other studies such as DAMeS [11], country of residence appears to be a significant symptom determinant even after controlling for a number of potential confounders. For the purpose of these reviews, we defined culture as either a country (in cross-country studies) or an ethnicity within a single nation.

A 2006 NIH-sponsored workshop on cross-cultural comparisons of menopause highlighted a number of issues, including whether menopause is a clearly-bounded entity and the role of culture in the perception and manifestations of menopause [12]. One key question is which symptoms, if any, constitute core menopausal symptoms, and should be included in all studies to enable cross-cultural comparisons. In the 2005 NIH consensus statement on menopausal symptoms, only hot flushes, night sweats, vaginal dryness and perhaps trouble sleeping were found to be reliably related to the menopausal transition [13], yet other research has found additional symptoms that peaked around menopause [14]. Another key question is concerned with which factors (eg, menopausal status and hormones, demographic, anthropometric, health, and lifestyle) influence the experience and reporting of those symptoms. Our goal in this paper is to review the methodologies currently used in the field of menopausal symptom research and to make recommendations for study design, symptom measurement and assessment, and reporting of results in order to facilitate rigorous cross-cultural comparisons across studies in the future.

Standardization of studies as outlined in our STROMA guidelines is necessary to facilitate cross-cultural comparisons, although attention to local variation in symptomatology is also required for a complete understanding of the variation in menopausal experience. Identifying the symptoms that are most bothersome to women during the menopausal transition

and distinguishing between those that are due to hormonal changes and those having aging- or socially-related etiology, is crucial for research, clinical care and public health policy.

2. Methods

In this overview we describe sample characteristics, age ranges, reference periods for symptom report, and definitions of menopause (**Table 1**), and make general recommendations to facilitate future cross-cultural research. In the subsequent symptom-specific reviews, methods of assessment, terminology for naming symptoms, symptom frequencies, and symptom determinants are compared to the extent possible for vasomotor, psychological, somatic and sexual symptoms.

[Table 1 goes about here]

We made *a priori* groupings of symptoms into vasomotor, psychological, somatic and sexual symptom categories despite overlaps. For example, palpitations, shortness of breath, fatigue, and dizziness are included in both psychological and somatic reviews (**Table 2**). These somatic symptoms may be due to physiological causation or disease. On the other hand, they may represent somatization of negative emotions or idioms of distress associated with anxiety or depression [15-17]. Sleep difficulties can overlap with several symptom groups, as they can result from psychological issues, sleep apnea or night sweats. Factor analyses suggest that fatigue, chest pain, dizziness, gastro-intestinal complaints, headaches, palpitations, numbness, and body aches at times cluster with psychological symptoms in some of the studies reviewed here [18-21]. The definitions and overlap of symptom groups are an important research area,

and existing research using factor analyses suggests that symptoms will not group in the same ways across cultures [21].

[Table 2 goes about here.]

To identify a new generation of cross-cultural studies, published since a previous review [6], PubMed, PsycINFO, CINAHL and Google Scholar were searched for English-language articles published from 2004-2010 using the terms "cross cultural comparison" and "menopause." Additionally, PubMed was searched for references related to specific symptom groups, methodologies, and associated factors. References of retrieved articles and reviews were hand-searched. Furthermore, studies and references that came to our attention at the Boston workshop [12] were also reviewed. Most studies are described in multiple publications. Criteria for the studies were an explicit cross-cultural or multi-ethnic design using similar methodologies across all sites/groups within each study, and explicit query and report of symptom experience in general, not clinical, populations. Across all sources, we identified 11 studies relevant to our aims: 8 are included in all four of the reviews that make up this series; 1 study is included in just two reviews; and 2 studies were excluded. Kowalcek et al. [22] conducted a cross-cultural study of pre- and postmenopausal women in Germany and Papua New Guinea, and queried expected, not experienced, menopausal problems among pre-menopausal women. Only post-menopausal women answered questions about their experience of menopausal problems (n=81). Krajewska-Ferishah et al. [23] conducted a cross-cultural study of QOL among women in Poland, Greece, Belarus and Belgium using the MRS scale, but only reported combined scores not individual symptoms. The Mid-Age Health in Women from the Indian Subcontinent (MAHWIS) study asked women in Birmingham, UK (n=103) and Delhi, India (n=50) to complete the Women's

Health Questionnaire (WHQ) [24]. Some (i.e., hot flushes, night sweats, vaginal dryness, and sexual satisfaction), but not all (i.e., psychological and somatic), symptom frequencies are published in text, not table, form [25]. Symptom frequencies from the MAHWIS study are included in only the vasomotor {Melby, in press #22896}. and sexual {Anderson, in press #22894} symptom review papers. The 8 studies included in all reviews are described below/or in Table 1.

2.1. Australian/ Japanese Midlife Women's Health Study (AJMWHS)

The aim of the AJMWHS was to explore the midlife experience of women living in Australia and Japan. Women were randomly selected by postal code from electoral rolls in Queensland and Nagano prefecture. The *Greene Climacteric Scale* [26] was used to measure the extent to which a woman is currently bothered by 21 symptoms on a scale of "not at all", "a little", "quite a bit", and "extremely". Analyses were performed to assess the influence of country of residence and menopausal status [7].

2.2. Decisions At Menopause Study (DAMeS)

The DAMeS was carried out to compare systematically the symptomatology of menopause across four countries that differ in terms of health services, construction of gender, and cultural notions of aging and health [11]. Sample recruitment was based on the: (a) sampling frame of the Population Laboratory of the American University of Beirut (Beirut, Lebanon); (b) sampling frame of the national Pan Arab Child Health Survey (Rabat, Morocco); (c) membership records of the Fallon Community Health Plan (FCHP), a mixed-model health

maintenance organization (Masschusetts, USA); and (d) random sample of women drawn from census lists in 20 districts (Madrid, Spain)

The *Everyday Complaint Listt* [27, 28], which embeds 'typical' menopause symptoms within a larger list of general health symptoms in order to reduce the likelihood that responses conform to prevalent stereotypes, was used as the base for the 25-item symptom list [11, 21], and translated and piloted in all countries. Women were asked: "During the past month, have you experienced any of the following?" In the U.S. and Spain, each symptom was recorded as yes/no. In Morocco and Lebanon, each symptom was recorded as never, regular or occasionally [29, 30].

2.3. Four Major Ethnic Groups (FMEG)

The purpose of the FMEG study was to examine ethnic differences in symptom experience during the menopausal transition among 512 women aged 40-60 across geographically dispersed areas. Internet communities formed by middle-aged women and internet groups for ethnic minorities formed by churches, organizations, health care centers, and professional groups were contacted and asked to announce the study. Self-reported ethnicity included Hispanic, non-Hispanic white, non-Hispanic African American, and non-Hispanic Asian [31]. The Midlife Women's Symptom Index [32] was used to query the presence and severity of 73 vasomotor, physical, psychological, and psychosomatic symptoms during the past 6 months. Stepwise regression analyses were carried out to assess the determinants of the total number of menopausal symptoms [31].

2.4. Hilo Women's Health Survey (HWHS)

This cross-sectional study surveyed women's health in the multi-ethnic city of Hilo, Hawaii. A random sample of households was selected using the County Map of Hawaii website to access tax map keys in the district of Hilo [33]. Household return rate was 28.5%; 1824 women aged 16-100 returned the survey. Ethnic groups included women of European, Japanese, Chinese, Filipino, and mixed Hawaiian descent. Among women aged 40-60, European-American (n=203) and Japanese-American (n=249) women represent the largest ethnic subgroups [33].

The *Everyday Complaint List* (described above in *2.2*) was modified for use in the HWHS following the piloting of the survey to women of European, Japanese, Chinese, and mixed ancestry[33]. Women were asked: "Thinking back over the past 2 weeks, have you ever been bothered by any of the following?" Participants were then presented with a list of 30 symptoms. Each symptom was recorded as yes/no.

2.5. Mid-Aged Health in Women from the Indian Subcontinent (MAHWIS)

MAHWIS was a cross-sectional, quantitative and qualitative interview study that compared Indian and white women living in Birmingham, UK, and Asian women living in Delhi, India. Women were recruited from the patient records of five general practitioners in Birmingham and by face-to-face recruitment and snowball techniques in Delhi. The *Women's Health Questionnaire* (WHQ) was used to measure 9 areas of symptom experience during the past 2 weeks [24, 25, 34]. In addition to vasomotor symptom frequencies, mean subscale scores are reported for depressed mood, somatic symptoms, vasomotor symptoms, anxiety/fears, sexual behavior, sleep problems, menstrual symptoms, memory/concentration, and attractiveness [25]. As discussed above, MAHWIS is included in only the vasomotor and sexual reviews.

2.6. Penn Ovarian Aging Study (POAS)

The POAS was a 10-year longitudinal population-based cohort study of European- and African-American women drawn from Philadelphia County, PA. Women were identified by random-digit dialing to 1,420 households. Of these, 218 African Americans and 218 European Americans enrolled [35]. Data were obtained in individual in-person interviews at participants' homes. The study offered a prospective examination of symptoms early in the transition to menopause [36].

The *Kupperman Menopausal Index* [37] was used to develop the *Menopause Symptom List* (MSL) used in the POAS [19]. Participants were asked which of 12 symptoms occurred in the past month, the frequency of each symptom, and severity from 0 (none) to 3 (severe). Additional instruments were also used and are described in the relevant reviews that follow.

2.7. Study of Women's Health Across the Nation (SWAN)

The goal of the SWAN was to describe the chronology of the biological and psychosocial characteristics of the menopausal transition and its effect on health and risk factors for age-related chronic diseases. Community-based samples of women were drawn from seven U.S. cities. Women self-identified as Caucasian (all sites), African-American (four sites), Chinese (one site), Hispanic (one site), and Japanese (one site) [18]. Twelve symptoms were selected from the *Everyday Complaint Checklist* and symptom presence during the past 2 weeks was queried [9, 18, 38-40]

2.8. Women's Health in Midlife National Study (WHiMNS)

The aim of this study was to examine differences in symptom reports and symptom clusters among women from different cultural origins living in Israel [20]. Women aged 45-64 were drawn from three groups: long term Jewish residents who arrived before 1989, Jewish immigrants who arrived from the former Soviet Union after 1989, and Arab Israelis. Participants were selected randomly from the National Population Registry, stratified by age and population group. A list of 16 symptoms experienced over the past 6 months was developed from three instruments [41-43]. Each positive response was followed by a question about how bothersome the symptom was on a 4 point Likert scale. Results are presented as the frequency of symptoms reported as bothersome. Factor analyses were used to create two scales for multivariate analyses: a mental symptom scale and a general somatic symptoms scale.

2.9. Women's International Study of Health and Sexuality (WISHeS)

The objectives of WISHeS were to depict patterns of symptoms across age and reproductive stages and to examine factors affecting symptom prevalence including country of origin. Women were recruited in France, Germany, the U.S. and U.K. through market research panels [14]. In Italy, recruitment was random, through door to door visits. Women with a history of hysterectomy, with and without bilateral oophorectomy, were purposefully recruited along with pre-, peri-, and naturally postmenopausal women. Symptom experience over the past month was queried for 29 symptoms derived from *MENQOL* [42] plus 7 additional symptoms. Bothersomeness was rated on a 7 point Likert scale, and symptoms were distinguished for analyses as clinically significant (≥3 on the scale of bothersomeness) or not (<3). A linear regression model for estimated prevalence at age 50 was constructed.

3. Results

The "Sample characteristics" column of Table 1 shows differences in age range across studies, from a narrow age range of 45-55 years [11] to a broad range of 20-70 [14]. Since age is associated with symptom experience, these age ranges most likely influence the symptom frequencies reported in the reviews that follow. There is more uniformity in methods of recruitment. All studies used general population (not clinical) samples, although records of general practitioners were used to identify women in the UK (MAHWIS) and HMO records were used to recruit women in the US (DAMeS). These women were not, however, seeking assistance for concerns related to menopause. Most of the studies recruited samples through some type of randomized list, with the exception of snowball sampling among Hispanic and Japanese participants in the US (SWAN), Indian participants in Delhi (MAHWIS), and targeted internet sites (FMEG). Data collection ranged from face-to-face interviews to postal, telephone, and internet surveys. Six different symptom lists were employed, and the reference period for symptom recall ranged from current symptoms (AJMWHS) to the past two weeks (HWHS, MAHWIS, SWAN), four weeks (DAMeS, POAS, WISHeS) and six months (FMEG, WHiMNS). Some questionnaires only asked about the presence/absence of symptoms (HWHS, MAHWIS, SWAN), while others included scales of severity (AJMWHS, FMEG), and/or a question specific to the bothersomeness of symptoms (DAMeS, HWHS, WISHeS). Factors included in multivariate analyses, and the measurement of those factors, were similarly variable across studies (Table 3).

[Table 3 goes about here.]

Table 3 lists the factors examined in relation to symptom frequencies in each study. Not all symptoms were examined in multivariate models. For example, in the HWHS only the presence/absence of hot flushes and night sweats were the outcomes of multivariate models. In the POAS, severity of hot flushes, aches/joint pain/stiffness, depressed mood, poor sleep, decreased libido, and vaginal dryness were examined in linear regression models. How these factors were assessed varies across studies, as illustrated with the example of menopausal status (Table 4).

[Table 4 goes about here.]

4. Discussion and recommendations

4.1 Age range

A broad age range facilitates the testing of hypotheses about aging vs. menopause (WISHeS). For longitudinal studies, it makes sense to start with a relatively young age range in order to follow women through the menopausal transition (SWAN, POAS). It is more difficult to recommend a firm age range for cross-sectional studies. Since median ages at menopause tend to be younger in developing countries [44], cross-sectional studies that involve developing countries should include women younger than 45 to capture the perimenopausal experience. However, in western, post-industrial countries, the median ages at menopause hover between 50 and 52, suggesting that studies of the menopausal transition should begin around 45. For cross-cultural work, we recommend the age range of 45 to 55, but encourage culture-specific flexibility to sample women aged 40-60 to better embrace variability in reproductive aging where relevant.

4.2 *Menopausal status*

There is variation in the definition of menopause (**Table 4**) and in inclusion/exclusion of women across studies. We advocate for staging the menopausal transition based on the consensus statement from the Stages of Reproductive Aging Workshop (STRAW) [45]. This involves asking women about more than their last menstrual period and history of hysterectomy. For example in the POAS, menopausal stage was assessed using menstrual dates, daily symptom diaries, number of menstrual periods between assessments, cycle length, and number of bleeding days. Follicle stimulating hormone (FSH), Anti-Mullerian Hormone (AMH), and inhibin-B levels can be combined with menstrual history to place women into stages; however, hormonal fluctuations during the peri-menopause limit the utility of one-time hormone measurements for identifying menopausal status.

4.3 *Reference period*

Most studies use either 2 week or 1 month recall. Asking women about symptom experience during the past 2 weeks does not necessarily capture the experience of peri-menopausal women who may have frequent hot flushes one month, but no hot flushes the next as hormone levels fluctuate from pre- to post-menopausal levels. A 4-week reference period is more likely to capture the erratic nature of hot flushes and give a more accurate sense of who is symptomatic. Ideally, someone should do a study with both, since we do not have good data on how these relate, e.g., are 1 month recall symptom frequencies similar to, or double, 2 week recall symptom frequencies? Asking about symptom experience during the past 6 months makes it difficult to match symptom experience with stress, diet, or activity patterns at the time of interview. Long (>1 month) or ambiguous recall periods should not be used.

4.4 *Symptom assessment*

Six different symptom lists were used in the studies reviewed here, highlighting the difficulty encountered when trying to draw comparisons across studies. Instruments should refer to a core group of symptoms experienced everywhere (**Table 5**), but the exact formulation of the questions about symptoms may be adjusted to the nuances with which they are perceived and expressed across cultures. One of the primary methodological challenges with conducting cross-cultural studies of menopausal symptoms is ensuring *measurement equivalence* (measuring the same construct with similar precision across different populations), which involves translation of questions and response categories to ensure similar interpretations [8]. In addition to core symptoms, there is also a need to add local- or population-specific symptoms [46]. The study should be framed and presented to participants as general research about women's health to avoid the reporting bias that can occur if women are asked only about menopausal symptoms, or if they know or believe the study to be primarily about menopause. An overall measure of symptom burden and reporting can help determine whether systematic over- or under-reporting at some sites or in some subgroups exists, e.g., among the Japanese-Americans in Hilo (Brown et al. 2009). Embedding menopausal symptoms in an everyday complaint list also permits assessment of overall symptom reporting. Asking about general health assessment might also be useful to compare morbidity in populations.

[Table 5 goes about here.]

4.5 *Symptom bothersomeness*

We also recommend that in addition to symptom presence (yes/no) or frequency, researchers investigate bothersomeness for a measure of how symptom experience affects quality of life. Questions about bothersomeness or interference with daily life would have to be measured in a way that is adapted to cultural context [8].

4.6 *Subjective/objective measures*

Where possible, objective measures avoid the problem of cultural reporting bias [47, 48] and provide an alternative source of information about symptom experience. For example, objective hot flush measurement using sternal skin conductance provides a measure of sweating that indicates a physiological hot flush, whether a woman experiences the hot flush or not [49, 50]. These objective measures have shown differences in hot flush frequencies related to religious practices [51] that a study of subjective report would have missed. Measures of flexibility, muscle strength, and balance [52, 53] can be used to supplement subjective somatic symptom reports.

4.7 Reporting of data

Reporting of datais almost as important as symptom assessment for cross-study comparisons. We recommend that symptom groupings within frequency tables be based on culture-specific evidence, e.g., from factor analyses. We recommend that frequencies be given for all symptoms queried. When studies do not report individual symptoms, but rather groupings and scales, then symptom frequencies cannot be compared. The constituent symptoms of the subscales and symptom groups vary considerably between studies and instruments used, making comparisons between studies almost impossible. Researchers carry out multi-part studies that

lend themselves to a number of publications with different foci. One result of this strategy can be the lack of a simple symptom frequency overview. Also, as shown in Table 3, not all symptoms are examined using multivariate analyses. The studies reviewed here are recent, and not all of their results have been published. We advocate for a symptom frequency list that makes cross-study comparisons possible. We also recommend that symptom frequencies be reported by menopausal status subgroups, in addition to total symptom frequencies.

4.8 Analysis and modeling of data

The use of different methodology, instruments and checklists increases the difficulty of making comparisons, but comparisons are also made difficult by variation in analyses. It is encouraging to see researchers move beyond simple bivariate associations to investigate more complex relationships. More sophisticated models allow for the assessment of symptom change across longitudinal studies (POAS), or permit the separation of menopause and aging effects using not just linear but non-linear relationships (eg, quadratic relationships with age), especially for symptoms that are expected to peak at menopause (WISHeS). In WISHeS, analyses distinguished between symptoms influenced by natural aging (predicted to show a linear relationship with age) versus those influenced by hormonal changes of menopause (predicted to show an inverted U-shaped curve; using age^2 in models) [14]. Presentation of the results was done in the form of a table of coefficients for relevant variables (such as age, age^2, mental and physical morbidity, early surgery, BMI), allowing others to estimate symptom prevalence for populations with particular characteristics (such as surgical menopause or low vs. high co-morbidities). [14],

Ideally we would have liked to have been able to provide cross-cultural estimates for the contributions of various demographic, socioeconomic and anthropometric factors to the variability of symptom prevalence and severity. However, the factors included in multivariate models varied widely among studies. Also, in some populations, inadequate variation in factors may prevent the observation of relationships among them. For example, in a population with a high mean BMI, the BMI range may be narrow, thus preventing the observation of relationships between body fat and symptoms. Data that should be systematically included in multivariate models include : menopausal status (based on STRAW) and hormonal measures (mean values and variance); demographic data (age, country/ethnicity); anthropometric data (BMI, waist circumference); mental and physical health morbidity details (self-assessment of general, physical/mental health (particularly depression, anxiety, and perceived stress); lifestyle-related behaviors (smoking, alcohol consumption, diet, exercise/activity level), as well as cultural factors (religion, acculturation, medicalization and attitudes toward menstruation, menopause, and aging). Ideally, BMI and waist circumference (a measure of fat patterning) would be measured by the researcher rather than self-reported. These measurements are inexpensive, quick, and noninvasive. Specifics of diet, e.g. food rich in phytoestrogens, amounts of fruit and vegetables eaten per day, meat, daily calcium, and caffeine intake, would facilitate comparison of studies.

Few studies conform to the guidelines outlined in STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) [54] – and we would like to recommend that future population studies of menopausal symptoms follow their checklist (available free from www.strobe-statement.org) to enable study comparisons. In addition to the STROBE guidelines, we propose guidelines for Strengthening The Reporting Of Menopause & Aging

(STROMA) studies (**Table 6**), where we list study design, analysis and reporting requirements and recommendations for future cross-cultural comparisons of menopause.

5. Conclusions

In our review of the cross-cultural studies described above, we noted a serious bias toward a focus on vasomotor symptoms. We have tried to balance that bias by reviewing psychological, somatic and sexual symptoms as well. While many non-vasomotor symptoms may not have their origin in the hormonal changes of the perimenopause, they may be exacerbated by such changes. In some of the studies reviewed here, somatic symptoms were reported more frequently than vasomotor symptoms. We have also tried to highlight the interconnectedness and multi-directional influences of symptoms on each other: (a) anxiety and depression may influence vasomotor and sexual symptoms; (b) vasomotor symptoms may affect sleep; (c) somatic and sexual symptoms may cause depression; (d) psychological symptoms may be somaticized.

Although some researchers may be primarily interested in vasomotor symptoms, we recommend that measures of mental and physical morbidity be included in any cross-cultural study of menopausal symptoms, as these often vary by ethnic/culture group and contribute significantly to prevalence rates (or bothersome rates). In longitudinal studies, psychological symptoms such as anxiety and depression often precede, and appear to influence rates of, vasomotor symptoms [35, 55]. These results highlight the difficulty of separating symptoms into neat categories or domains, and argue for the collection of data on some symptoms in all 4 domains in any study. Guidelines for Strengthening The Reporting Of Menopause & Aging (STROMA) studies are provided in **Table 6**, and we hope that future researchers will endeavor

to collect and report these data, and that journals will publish all data necessary to facilitate rigorous cross-cultural comparisons.

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Contributors

Paper conception, review, data extraction, drafting of manuscript and preparation of tables were done by MKM, LLS, and DA. Critical review and editing was done MKM, LLS, DA and CMO.

Competing interests

None of the authors have a conflict of interest or competing interests.

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REFERENCES

[1] Melby MK, Anderson D, Sievert LL, Obermeyer CM. Methods used in cross-cultural comparisons of vasomotor symptoms and their determinants. Maturitas in press;
[2] Anderson D, Melby MK, Sievert LL, Obermeyer CM. Methods used in cross-cultural comparisons of psychological symptoms and their determinants. Maturitas in press;
[3] Sievert LL, Anderson D, Melby MK, Obermeyer CM. Methods used in cross-cultural comparisons of somatic symptoms and their determinants. Maturitas in press;
[4] Anderson D, Sievert LL, Melby MK, Obermeyer CM. Methods used in cross-cultural comparisons of sexual symptoms and their determinants. Maturitas in press;

[5] Freeman EW, Sherif K. Prevalence of hot flushes and night sweats around the world: a systematic review. Climacteric 2007;10:197-214.
[6] Melby MK, Lock M, Kaufert P. Culture and symptom reporting at menopause. Human Reproduction Update 2005;11:495-512.
[7] Anderson D, Yoshizawa T, Gollschewski S, Atogami F, Courtney M. Menopause in Australia and Japan: effects of country of residence on menopausal status and menopausal symptoms. Climacteric 2004;7:165-74.
[8] Crawford SL. The roles of biologic and nonbiologic factors in cultural differences in vasomotor symptoms measured by surveys. Menopause 2007;14:725-33.
[9] Gold EB, Colvin A, Avis N, Bromberger J, Greendale GA, Powell L et al. Longitudinal analysis of the association between vasomotor symptoms and race/ethnicity across the menopausal transition: study of women's health across the nation. Am J Public Health 2006;96:1226-35.
[10] Avis NE, Colvin A. Disentangling cultural issues in quality of life data. Menopause 2007;14:708-16.
[11] Obermeyer CM, Reher D, Saliba M. Symptoms, menopause status, and country differences: a comparative analysis from DAMES. Menopause 2007;14:788-97.
[12] Obermeyer CM, Sievert LL. Cross-cultural comparisons: midlife, aging, and menopause. Menopause 2007;14:663-7.
[13] NIH State-of-the-Science Conference Statement on management of menopause-related symptoms. NIH Consens State Sci Statements 2005;22:1-38.
[14] Dennerstein L, Lehert P, Koochaki PE, Graziottin A, Leiblum S, Alexander JL. A symptomatic approach to understanding women's health experiences: a cross-cultural comparison of women aged 20 to 70 years. Menopause 2007;14:688-96.
[15] Gureje O, Simon GE, Ustun TB, Goldberg DP. Somatization in cross-cultural perspective: a World Health Organization study in primary care. Am J Psychiatry 1997;154:989-95.
[16] Nichter M. Coming to our senses: appreciating the sensorial in medical anthropology. Transcult Psychiatry 2008;45:163-97.
[17] Simon G, Gater R, Kisely S, Piccinelli M. Somatic symptoms of distress: an international primary care study. Psychosom Med 1996;58:481-8.
[18] Avis NE, Stellato R, Crawford S, Bromberger J, Ganz P, Cain V et al. Is there a menopausal syndrome? Menopausal status and symptoms across racial/ethnic groups. Soc Sci Med 2001;52:345-56.
[19] Freeman EW, Sammel MD, Liu L, Martin P. Psychometric properties of a menopausal symptom list. Menopause 2003;10:258-65.
[20] Lerner-Geva L, Boyko V, Blumstein T, Benyamini Y. The impact of education, cultural background, and lifestyle on symptoms of the menopausal transition: the Women's Health at Midlife Study. J Womens Health (Larchmt) 2010;19:975-85.
[21] Sievert LL, Obermeyer CM, Saliba M. Symptom groupings at midlife: cross-cultural variation and association with job, home, and life change. Menopause 2007;14:798-807.
[22] Kowalcek I, Rotte D, Banz C, Diedrich K. Women's attitude and perceptions towards menopause in different cultures. Cross-cultural and intra-cultural comparison of pre-menopausal and post-menopausal women in Germany and in Papua New Guinea. Maturitas 2005;51:227-35.
[23] Krajewska-Ferishah K, Krajewska-Kulak E, Terlikowski S, Wiktor H, Van Damme-Ostapowicz K, Chadzopulu A et al. Analysis of quality of life of women in menopause period in Poland, Greece, Belarus and Belgium using MRS Scale. A multicenter study. Adv Med Sci 55:191-5.
[24] Hunter MS, Gupta P, Papitsch-Clark A, Sturdee DW. Mid-Aged Health in Women from the Indian Subcontinent (MAHWIS): a further quantitative and qualitative investigation of experience of menopause in UK Asian women, compared to UK Caucasian women and women living in Delhi. Climacteric 2009;12:26-37.

[25] Gupta P, Sturdee DW, Hunter MS. Mid-age health in women from the Indian subcontinent (MAHWIS): general health and the experience of menopause in women. Climacteric 2006;9:13-22.
[26] Greene JG. Constructing a standard climacteric scale. Maturitas 1998;29:25-31.
[27] Avis NE, Kaufert PA, Lock M, McKinlay SM, Vass K. The evolution of menopausal symptoms. Baillieres Clinical Endocrinology and Metabolism 1993;7:17-32.
[28] Lock M. Menopause: Lessons from anthropology. Psychosom Med 1998;60:410-9.
[29] Obermeyer CM, Schulein M, Hajji N, Azelmat M. Menopause in Morocco: symptomatology and medical management. Maturitas 2002;41:87-95.
[30] Obermeyer CM, Ghorayeb F, Reynolds R. Symptom reporting around the menopause in Beirut, Lebanon. Maturitas 1999;33:249-58.
[31] Im EO, Lee B, Chee W, Brown A, Dormire S. Menopausal symptoms among four major ethnic groups in the United States. West J Nurs Res 2010;32:540-65.
[32] Im EO. The Midlife Women's Symptom Index (MSI). Health Care Women Int 2006;27:268-87.
[33] Sievert LL, Morrison L, Brown DE, Reza AM. Vasomotor symptoms among Japanese-American and European-American women living in Hilo, Hawaii. Menopause 2007;14:261-9.
[34] Hunter MS. The women's health questionnaire- a measure of mid-aged women's perceptions of their emotional and physical health. Psychology and Health 1992;7:45-54.
[35] Freeman EW, Sammel MD, Lin H, Gracia CR, Kapoor S, Ferdousi T. The role of anxiety and hormonal changes in menopausal hot flashes. Menopause 2005;12:258-66.
[36] Freeman EW, Sammel MD, Lin H, Gracia CR, Pien GW, Nelson DB et al. Symptoms associated with menopausal transition and reproductive hormones in midlife women. Obstet Gynecol 2007;110:230-40.
[37] Kupperman HS, Wetchler BB, Blatt MH. Contemporary therapy of the menopausal syndrome. Jama 1959;171:1627-37.
[38] Gold EB, Sternfeld B, Kelsey JL, Brown C, Mouton C, Reame N et al. Relation of demographic and lifestyle factors to symptoms in a multi-racial/ethnic population of women 40-55 years of age. Am J Epidemiol 2000;152:463-73.
[39] Gold EB, Block G, Crawford S, Lachance L, FitzGerald G, Miracle H et al. Lifestyle and Demographic Factors in Relation to Vasomotor Symptoms: Baseline Results from the Study of Women's Health Across the Nation. Am J Epidemiol 2004;159:1189-99.
[40] Thurston RC, Sowers MR, Chang Y, Sternfeld B, Gold EB, Johnston JM et al. Adiposity and reporting of vasomotor symptoms among midlife women: the study of women's health across the nation. Am J Epidemiol 2008;167:78-85.
[41] Greene JG. A factor analytic study of climacteric symptoms. J Psychosom Res 1976;20:425-30.
[42] Hilditch JR, Lewis J, Peter A, van Maris B, Ross A, Franssen E et al. A menopause-specific quality of life questionnaire: development and psychometric propertie. Maturitas 1996;24:161-75.
[43] Moss-Morris R, Weinman J, Petrie KJ, Horne R, Cameron LD, Buick D. The revised illness perception questionnaire (IPQ-R). Psychol Health 2002;17:1-16.
[44] Gonzales G, Villena A. Age at menopause in Central Andean Peruvian women. Menopause: The Journal of the North American Menopause Society 1997;4:32-8.
[45] Soules MR, Sherman S, Parrott E, Rebar R, Santoro N, Utian W et al. Stages of Reproductive Aging Workshop (STRAW). J Womens Health Gend Based Med 2001;10:843-8.
[46] Parsons MA, Obermeyer CM. Women's midlife health across cultures: DAMES comparative analysis. Menopause 2007;14:760-8.
[47] Brown DE, Sievert LL, Morrison LA, Reza AM, Mills PS. Do Japanese American women really have fewer hot flashes than European Americans? The Hilo Women's Health Study. Menopause 2009;16:870-6.
[48] Draper P. Conducting cross-cultural research in teams and the search for the "culture-proof" variable. Menopause 2007;14:680-7.

[49] Freedman RR. Laboratory and ambulatory monitoring of menopausal hot flashes. Psychophysiology 1989;26:573-9.
[50] Carpenter JS, Andrykowski MA, Freedman RR, Munn R. Feasibility and psychometrics of an ambulatory hot flash monitoring device. Menopause 1999;6:209-15.
[51] Sievert LL, Begum K, Sharmeen T, Chowdhury O, Muttukrishna S, Bentley G. Patterns of occurrence and concordance between subjective and objective hot flashes among Muslim and Hindu women in Sylhet, Bangladesh. Am J Hum Biol 2008;20:598-604.
[52] Cheng KC, McKay SM, King EC, Tung JY, Lee TA, Scovil CY et al. The moveable handhold: a new paradigm to study visual contributions to the control of balance-recovery reactions. Gait Posture 2009;29:339-42.
[53] Sowers M, Tomey K, Jannausch M, Eyvazzadeh A, Nan B, Randolph J, Jr. Physical functioning and menopause states. Obstet Gynecol 2007;110:1290-6.
[54] Vandenbroucke JP, von Elm E, Altman DG, Gotzsche PC, Mulrow CD, Pocock SJ et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. Epidemiology 2007;18:805-35.
[55] Dennerstein L, Lehert P, Guthrie JR, Burger HG. Modeling women's health during the menopausal transition: a longitudinal analysis. Menopause 2007;14:53-62.