

Gender influence on health and risk behavior in primary prevention: a systematic review

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Abstract

Aim Prevention plays a crucial part in healthcare systems and is greatly influenced by the health and risk behavior of the population. The extent to which special tailoring to the addressed subjects would be helpful in improving the effectiveness of prevention measures is unknown. Therefore, the goal of this systematic review is to assess gender-specific differences in primary prevention actions.

Subject and Methods A systematic review was conducted in 2015 by searching the PubMed (Medline) and Cochrane Library databases as well as adding additional studies by cross-referencing. The search focused on studies with an analysis of gender differences in health and risk behavior concerning primary prevention. Therefore, major exclusion criteria were single-gender studies, underage (<18 years) study collectives and secondary or tertiary prevention measures.

Results In total, 23 studies from 13 different countries were included in the qualitative evaluation. The studies covered 11 different subtopics of primary prevention, but were too diverse in content and type to draw many fundamental conclusions. A meta-analysis was not possible. Generally a tendency for females to be more health-conscious and engaged in preventive behavior could be seen in most subgroups.

Conclusion The importance of gender-specific prevention measures for the healthcare system is being increasingly stressed, but only a few studies specifically analyzing the

influence of gender on preventive behavior could be identified. To implement appropriate primary prevention measures tailored to gender-specific needs, more details and studies on gender differences are needed.

Keywords Gender · Health behavior · Risk behavior · Primary prevention

Background and aim

Prevention plays a crucial part in healthcare systems and politics around the world. Due to the demographic change and the increase of widespread diseases such as ischemic heart disease, COPD, stroke and others, the call for further action and primary prevention strategies targeting the causes of chronic diseases before they even develop is urgent. Today, behavior itself is one of the heaviest burdens of disease and directly associated with worldwide health problems such as unhealthy nutrition (Hamburg and Sartorius 1989). Prevention is the key to counteracting these risks.

Disease prevention has long been categorized in primary, secondary and tertiary prevention (Gordon 1983). In this review we focus on primary prevention tailored to measures taken prior to the biological origin of disease (Gordon 1983). It therefore starts before harm, illness or a non-compliant behavior occurs and searches for the causes and risk factors which may lead to them (DGNP 2015). The prevalent health and risk behavior in the population greatly influences primary prevention strategies.

In Germany, the question about gender influence on prevention strategies arose in the wake of the German Preventive Health Care Act (PrävG 2015). This act, which was passed in 2015, states that gender-specific characteristics should be accounted for. Males and females are known to differ in their

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Table 1 Search terms PubMed database (search date: 04/22/2015)

Gender AND differences AND (health behavior OR risk behavior) AND primary prevention AND (adolescents OR adults)	292
Gender differences AND lifestyle AND primary prevention AND (adolescents OR adults)	75
Gender differences AND provision AND prevention AND (health behavior OR risk behavior) AND (adolescents OR adults)	66
Gender differences AND precaution	12
Gender differences AND occupational AND primary prevention	38
Total	483
Minus duplicates/triplicates	- 22 hits
Final total	461

disease spectrum and behavior, which surely influences the effectiveness of preventive strategies.

The World Health Organization (WHO) has also long been committed to eliminating disparities including gender mainstreaming to improve overall health and recently reconfirmed the integration of gender, equity, human rights and social determinants in its 12th general program of work (WHO 2014). In its roadmap to action concerning this topic, the WHO not only wants to provide guidance on integrating program approaches that are gender-responsive, but also stresses the need for disaggregated data analysis and health inequality monitoring (WHO 2015). To gain a comprehensive overview and synthesis of empirical data on gender differences we therefore addressed the question “Does gender have an influence on primary prevention actions (e.g., health and risk behavior)?” in a systematic review.

Subject and methods

When addressing the study question, considerations about the desired participants, interventions, comparisons and outcomes are important and lead to the inclusion and exclusion criteria. We conducted a systematic review of the research on gender differences in health and risk behavior with a special focus on primary prevention and the health behavior of the general population. To assess and evaluate the effect of gender-specific differences in primary prevention measures, a comparison between the respective behavior of men and women with regard to specific topics had to be drawn. It was a requirement that the studies both covered a topic concerning primary prevention and evaluate gender differences in order to qualify. By assuming that the distinction between the terms ‘sex’ and ‘gender’ is not always used in the correct sense, the term ‘sex’ was considered for further evaluation as well.

The search methodology was in line with Allison et al. (1999). Two researchers (J.H. and K.S.) independently screened and

reviewed the search results in the following order: titles, abstracts and full-text papers. If necessary, a third person (H.D.) was consulted. The following eligibility criteria were defined prior to the search process:

Exclusion criteria:

- Study questions concerning males only
- Study questions concerning females only, pregnancy prevention
- Study population predominantly under 18 years of age or with a median/average age under 18 years
- Preventive measures by physicians, except when physicians were clients themselves
- Analysis of gender-specific subgroups only: homosexual, lesbian, bisexual, transgender
- Violence prevention
- Secondary prevention only
- Tertiary prevention only
- Study language neither English nor German
- No clear separation of prevention in ‘primary, secondary, tertiary’ possible
- No gender analysis conducted

In the appraisal process, studies were excluded if their full text only referred to the occurrence of one or more of the following disease risk factors without other primary prevention data being available in the same study: overweight/obesity, smoking behavior and substance consumption (alcohol, drugs).

We started searching the literature databases with the basic terms concerning the topic. However, this resulted in a very high quantity of retrieved articles that seemed to miss the necessary relevance and quality. Therefore, the search strategy was tailored by combining more explicit prevention search terms to enhance the precision of the search. As a consequence we searched the PubMed (Medline) and Cochrane Library databases in 2015 using the listed terms (Tables 1 and 2) and initially identified 591 studies. After eliminating duplicates, 565 studies remained for further evaluation. Through cross

Table 2 Search terms Cochrane Library database (search date 06/03/2015)

Gender differences AND primary prevention	108 (including 3 Cochrane reviews, 1 other review, 103 CENTRAL trials, 1 method study)
Duplicates	- 4
Total	104

references another $n = 58$ records were added to the screening. After applying the exclusion criteria to the title and abstract screening, the remaining full texts ($n = 106$) were assessed for eligibility (see PRISMA flow chart) (Moher et al. 2009) (Fig. 1).

The studies were grouped according to the covered prevention topic and the study type evaluated in line with Grimes et al. (2002). We extracted all data concerning gender differences in primary prevention, in terms of either gender proportions or their statistical analysis, such as odds ratios or chi square values, and, if existing, p -values. Since the prevention topics, study outcomes and analytic methods varied by article, a meta-analysis could not be performed. (A table summarizing

the statistical data of all individual studies used to reach the deduced conclusions concerning each subtopic can be requested from the authors.)

After the initial search process and eligibility decision on the retrieved publications, it became clear that a number of studies ($n = 33$) had been carried out many years ago. As the goal of this review was to help decide on current actions to take, the topicality of the conclusions is important since behavior and social structures change over the course of time because of increasing industrialization in developing countries or changing standards in the society. It was therefore decided to confine the study period for the final qualitative synthesis to 2000–2015 with the year 2000 being selected as the cutoff point to allow for the inclusion of more recent studies while excluding obsolete findings and potentially outdated conclusions, leaving $n = 23$ studies for evaluation (see flow diagram).

Results

Initially, 56 articles met the inclusion criteria, with 23 studies being left after confining the study period. We identified a further eight reviews covering some of the topics of interest, five of which were published after the year 2000. Where possible they were used for comparison with the individual studies.

Topics of examined preventive behavior

Table 3 shows the methodological approach, type of preventive behavior and general data of the 23 studies. The studies included in the full-text analysis were categorized into the following subgroups of primary prevention: dental health behavior ($n = 1$), gathering health information ($n = 1$), hygiene ($n = 3$), lifestyle modification ($n = 1$), mental health ($n = 1$), nutrition ($n = 1$), occupational disease prevention ($n = 3$), physical activity ($n = 5$), sexual behavior ($n = 3$), sun protection behavior ($n = 2$) and vaccination ($n = 6$).

Article characteristics

The study population sizes ranged from $n = 122$ to $n = 13,002$ (Jaarsma et al. 2004; Wu et al. 2013). Data collection generally started in the year 2000 or later, although one still ongoing study began in 1988 (Edjolo et al. 2013). The study collectives were located around the world with a slight emphasis on North America ($n = 9$) followed by other geographic and cultural regions in Europe ($n = 5$), Asia ($n = 4$), Australia ($n = 3$) and Africa ($n = 2$). In detail, the countries involved were the USA ($n = 9$), China ($n = 1$), Japan ($n = 1$), Sri Lanka ($n = 1$), Iran ($n = 1$), Australia ($n = 3$), Ethiopia ($n = 1$), Tanzania ($n = 1$),

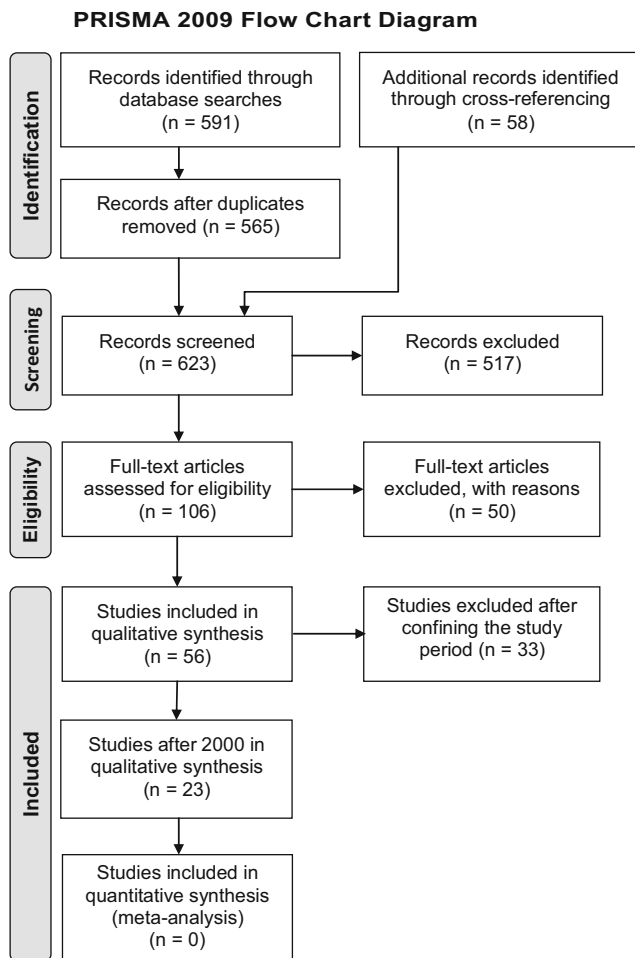


Fig. 1 PRISMA 2009 flow chart diagram (Moher et al. 2009)

Table 3 Result overview—general data and topic

No.	Reference (author, year)	Country	Study type/collection method	Study duration/year of data	Type of preventive behavior	Study population size (n)	Study population age (years)	Gender distribution (n)	Funding source
1	Alemu et al. (2011)	Ethiopia	Cross-sectional study, structured questionnaire, systematic random sampling, young people with disability	February 11–17, 2008	Sexual	384	10–24 (majority in the age range of 20–24)	50.5% males 49.5% females	Cheshire Foundation Ethiopia
2	Askarian et al. (2009)	Iran	Cross-sectional study, self-administered questionnaire, stratified sample, healthcare workers	November 2005–February 2006	Occupational disease	851 (participation rate 96%)	18–59, mean age 25.9 SD 5.4	n.a.	Deputy of Research at the Shiraz University of Medical Sciences
3	Boehner et al. (2003)	USA	Cross-sectional study, written questionnaire, college students	n.a.	Vaccination	259	20.2 mean age	50% males 50% females	n.a.
4	Edjolo et al. (2013)	France	Cohort study, epidemiological prospective study (French Personnes Agées Quid (PAQUID) cohort) Random recruiting from electoral roll, general population, face-to-face interview at home, re-interviews every 2–3 years over 20 years of follow-up	Started in 1988, still ongoing (status: September 2012)	Physical activity	2578	70–90 at baseline	41% males 59% females	n.a.
5	Fernandez-Esquer et al. (2004)	USA	Cross-sectional study, face-to-face interviews, data collected as part of a behavioral rapid needs assessment (BRNA) survey, US and foreign-born Latinos	November 2002–January 2003	Sexual	152	29.8 immigrant females 29.5 US-born Latina women 31.5 immigrant males	33% males 67% females	Houston Department of Health and Human Services, Bureau of HIV/STD (sexually transmitted diseases)
6	Gavin et al. (2012)	UK	Cross-sectional study, questionnaire based on a validated survey, included in Omnibus survey of the lifestyle and views of the Northern Ireland population, random sample of adults from private household addresses	2000, 2004, 2008 (8-year period)	Sun protection	3623 (response rates 50%–59%)	16 and over	1:1.2 male to female ratio	Public Health Agency, Northern Ireland, which funds work for Northern Ireland Cancer Registry; DHSSPSNI (Department of Health, Social Services & Public Safety, Northern Ireland)
7	Grgič-Vitek et al. (2012)	Slovenia	Cross-sectional study, face-to-face interviews at respondents' homes using paper questionnaires, general population	October–December 2007	Vaccination	2075 (survey response 68%, item response 98%)	15 and over	46.7% males 53.3% females	National Institute of Public Health
8	Jaarsma et al. (2004)	Sweden	Cross-sectional study, short, anonymous, self-reported questionnaire, registrants of 3rd annual Spring Meeting of the European Society of the Working Group on Cardiovascular Nursing	April 2003	Physical activity	122 (response rate 47%)	23–60 mean age of 41 (SD 9.4)	14% males 86% females	Supported by Biosite® Diagnostics Europe
9	Jackson and Villaroel (2012)	USA	Cross-sectional descriptive study, online questionnaire, Oregon veterinarians	June 16, 2008–September 5, 2008	Occupational disease	216 (completed response rate 16.9%)	30 and over	32.4% males 67.6% females	n.a.
10	Johnson et al. (2003)	USA	Cross-sectional study, observer in university restrooms, study population included public restroom visitors from a large northeastern university	1-week period	Hygiene	175	n.a.	46% males 54% females	n.a.
11	Jones and Cook (2008)	USA	Cross-sectional study, anonymous, self-administered, 34-item questionnaire, convenience sample, college students at a northeastern urban university	April 2006	Vaccination, sexual	340 (participation rate 96%)	18–32, mean age 20.8 (SD = 2.3)	41% males 59% females	n.a.

Table 3 (continued)

No.	Reference (author, year)	Country	Study type/collection method	Study duration/ year of data	Type of preventive behavior	Study population size (n)	Study population age (years)	Gender distribution (n)	Funding source
12	Karalliedde et al. (2014a, b)	Sri Lanka	Randomized controlled clinical trial, comparison of an intensive 3-month with a less intensive 12-month lifestyle modification	2010–2013	Lifestyle modification	3685 (L-LSM <i>n</i> = 1807) (L-LSM <i>n</i> = 1878)	5–40 (L-LSM 22.4 mean age ± 10 years SD) (L-LSM 22.4 mean age ± 9.8 years SD)	48% males 52% females	Supported by International Diabetes Federation (IDF) and National Diabetes Association of Sri Lanka
13	Lawler et al. (2007)	Australia	Cross-sectional study, self-administered questionnaire, convenience sampling, participants in hockey, soccer, tennis and surf sports	n.a.	Sun protection	237	18–30, mean age 23.2 ± 3.8	40.9% males 59.1% females	n.a.
14	Matthews et al. (2004)	USA	Cross-sectional study, telephone survey, convenience sample, family caregivers of patients admitted to a Medicare-certified home health agency	21-month period	Dental health, gathering health information, physical activity	319	50 and over	21.6% males 78.4% females	American Nurses Foundation and the Jewish Healthcare Foundation of Pittsburgh
15	Mohr et al. (2010)	Australia	Cross-sectional study, national postal survey, random selection, adults from Australian electoral roll	2008	Nutrition	849 (participation rate 40.4%)	18 and over	40.2% males 59.8% females	CSIRO (Commonwealth Scientific and Industrial Research Organization)
16	Nan (2012)	USA	Cross-sectional study, online survey questionnaire, undergraduate students without former HPV (human papilloma virus) vaccination	n.a.	Vaccination	229	18–26, mean age 20.18 (SD = 1.47)	56.3% males 43.7% females	n.a.
17	Njelele et al. (2009)	Tanzania	Cross-sectional epidemiological study, structured questionnaire, administered face-to-face, random selection, stratified list of adult residents	n.a.	Physical activity	209 (response rate 83.6%)	44–66	55% males 45% females	Sida (Swedish International Development Cooperation Agency)/SAREC (Sida Department for Research Cooperation) Capacity Development Project; Gender Center; University of Dar es Salaam (Tanzania)
18	Sax et al. (2007)	Switzerland	Cross-sectional study, internal mail, self-administered paper questionnaire at workplace, physicians, nurses, nursing assistants (Geneva University Hospitals)	October 2005	Hygiene	1008	n.a.	28.8% males 71.2% females	n.a.
19	Seale et al. (2006)	USA	Cross-sectional study, self-completed health habits questionnaire, adult outpatients of a family medicine clinic	June 2002–July 2003	Physical activity	3286 (1613 African-American, 1623 non-Hispanic White)	39.5 ± 14.9 (African-American) 45.0 ± 17.0 (non-Hispanic White)	35.6% males 64.4% females	n.a.
20	Takusari et al. (2011)	Japan	Cross-sectional study, anonymous, self-administered questionnaire, business employees	January 2008	Mental health	3233 included in analysis, 3944 responses (participation rate 82.1%)	Mean age 40.47 ± 11.42 years (males), 38.71 ± 10.53 years (females)	75.5% males 24.5% females	Supported by research investigation grant from Japan Labor Health and Welfare Organization
21	Van de Mortel et al. (2001)	Australia	Cross-sectional study, covertly observed handwashing by critical care unit staff with patient contact	n.a.	Hygiene	249	n.a.	63% males 37% females	n.a.
22	Wright et al. (2008)	USA	Cross-sectional study, mailed questionnaire; randomly selected veterinarians from AVMA (American Veterinary Medical Association) membership	2005	Occupational disease	316 large animal veterinarians (LAV), 456 equine veterinarians (EV)	24–77	LAV 81.2% males 18.8% females EV 57.6% males 42.4% females	n.a.

Table 3 (continued)

No.	Reference (author, year)	Country	Study type/collection method	Study duration/ year of data	Type of preventive behavior	Study population size (n)	Study population age (years)	Gender distribution (n)	Funding source
23	Wu et al. (2013)	China	Cross-sectional study, multi-stage sampling, retrospective, random selection, self-administered, anonymous questionnaires	January 2011	Vaccination	1070 small animal veterinarians (SAV); 2133 of 5168 returned completed questionnaires (participation rate 41%)	18 and over	SAV 47.6% males 52.4% females	Supported by research fund for National Important Project during Twelfth Five-Year Plan Period, 'Laboratory key technologies and technology systems for infectious disease surveillance,' Ministry of Science and Technology

France ($n = 1$), Slovenia ($n = 1$), Sweden ($n = 1$), Switzerland ($n = 1$) and the UK ($n = 1$).

The original study types included in this systematic review were mainly observational in the form of a cohort study ($n = 1$) and cross-sectional studies ($n = 21$), although one randomized controlled trial ($n = 1$) was also included. As mentioned earlier, five reviews on the analyzed topics published after the year 2000 were also identified during the search process and will be referred to in this work. Primary studies cited in these reviews were not assessed any further, nor were they included in this systematic review in order to avoid redundant consideration.

Summarized trend of preventive behavior between genders

The total number of study results indicating a better preventive behavior by one or the other gender with regard to subtopic and subsidiary inquired items is summarized in Table 4. As more than one subsidiary item could be examined within a subtopic, the total number of results is higher than the number of retrieved studies ($n = 23$). Overall, females were more often reported to show better preventive behavior ($n = 21$) than males ($n = 8$) or there were no gender differences at all ($n = 9$). In only four of the 20 different preventive behaviors from Table 4 did males show a prevention advantage.

Topic-specific presentation of the individual article results

The results of the Fung et al. (2007), National Center for Health Statistics (2012), Stanton et al. (2004), Wellings et al. (2006) and Wilkins et al. (2008) identified reviews were in line with the primary studies included in this work and covered gender differences in personal hygiene, sexual behavior and sun protection behavior. Therefore, articles identified concerning these subtopics will be discussed in further detail first. For other topics addressed in these reviews the available literature was sparse, and therefore sufficient conclusions on gender-specific health behavior could not be drawn.

Concerning hygiene, one review examined compliance with hand-washing connected to the 2003 SARS outbreak and predominately described a significant gender difference (female > male) when measured (Fung and Cairncross 2007). The three primary studies included in this review also found that more females were observed washing their hands in public restrooms, that female healthcare workers generally washed their hands more often than males (although differences existed among professions) and that the female sex had an independent impact on health-care workers' reported intentions to perform well in hand hygiene (Johnson et al. 2003; Sax et al. 2007; van de Mortel et al. 2001). Furthermore, males were less likely than females to show a high self-reported rate of hand hygiene (Sax et al. 2007).

Table 4 Overall trend of preventive behavior between genders within each subtopic and subsidiary inquired items

Preventive behavior item	Study results indicating a favorable preventive behavior shown ... (n*)		
	More by women	No difference between genders	More by men
Hygiene: hand-washing	3 + R	–	–
Sexual: fewer multiple partners	3 + 2xR	–	–
Sexual: later intercourse after meeting a new partner	R	–	–
Sexual: condom use	1	1	1 + 3xR
Sun: use of sunscreen	2 + R	–	–
Sun: higher sun protective behavior	1 + R	–	–
Sun: indoor tanning or sunbathing	–	–	1 + R
Sun: lower overall sun exposure	1 + R	–	–
Sun: higher use of clothing/hat	–	1	2
Physical activity: more exercise/activity	1	1	3
Lifestyle modifications	–	1	–
Occupational: vaccination uptake	1	1	–
Occupational: higher precaution awareness	1	–	–
Vaccination: uptake	2	2	1
Vaccination: uptake in self-paid vaccinations	1	1	–
Dental: regular flossing	1	–	–
Gathering of health information	1	–	–
Nutrition: higher fiber intake	1	–	–
Demand for mental health resources	–	1	–
Usage of mental health resources	1	–	–
Summary	21 + 6xR	9	8 + 4xR

*In some subtopics more than one subsidiary item was examined

+ R: review conclusion in favor of a gender difference from a pre-existing review [Fung et al. (2007), National Center for Health Statistics (2012), Stanton et al. (2004), Wellings et al. (2006), Wilkins et al. (2008)] concerning the subtopic in question

Reviews and studies addressing gender differences in sexual behavior focus on condom use, number of sexual partners and communication about sex/sexual history. However this primary prevention subgroup should be viewed as a special case because sexual behavior is widely influenced by country-specific backgrounds, risk collectives and socially desirable behavior. The primary studies identified with data collection after the year 2000 all addressed specific subgroups such as young people with disability in Africa, Latinos living in the US and US college students (Alemu and Fantahun 2011; Fernandez-Esquer et al. 2004; Jones and Cook 2008). The existing reviews showed that it is more common for males to report multiple sexual partners and having sexual intercourse soon after meeting a new partner (Wellings et al. 2006; Wilkins et al. 2008). Males tend to be more likely to use condoms, although in parts this was restricted to penetrative sex in contrast to other sexual activities (National Center for Health Statistics 2012; Wellings et al. 2006; Wilkins et al. 2008). This also held true for the primary studies regarding sexual partners, with more males reporting more partners (Alemu and Fantahun 2011; Fernandez-Esquer et al. 2004;

Jones and Cook 2008). In contrast, condom use also yielded differential results, with gender being a non-significant predictor of condom use in the most recent sexual encounter. Being a woman was associated with higher odds for condom use with the primary partner, whereas males tended to use condoms more often with casual sex partners (Alemu and Fantahun 2011; Fernandez-Esquer et al. 2004). A test of significance was not always performed.

Concerning sun protection behavior, the existing review described females as more likely to use sunscreen and engage in more sun protective behaviors (Stanton et al. 2004). However, they were also more likely to use indoor tanning salons or to sunbathe intentionally, while males have greater sun exposure altogether (Stanton et al. 2004). In line with these findings, the primary studies found significantly more females used sunscreen and avoided the sun, but that males were more likely to wear a hat and to not sunbathe at home (Gavin et al. 2012). Lawler et al. (2007) explored sun protection while doing sports. In line with general trends, females were more likely to use sunscreen, especially when playing soccer and hockey, as well as during matches. Hat usage

varied significantly by sport and gender and was influenced by external factors (“permission to wear a hat”); therefore, a universal message cannot be deduced. Concerning protective clothing, gender differences were recorded for the shirt type worn in soccer and hockey and for the short/skirt length in tennis. Males were more likely to wear shirts with sleeves, while more females wore sleeveless shirts for soccer and hockey, and in tennis shorter pants or skirts were more likely to be worn by females (Lawler et al. 2007).

No up-to-date reviews could be identified for the other analyzed primary prevention topics.

With regard to physical activity more males tended to exercise to stay healthy (Matthews et al. 2004). Females were found to be significantly more inactive than males (Seale et al. 2006). The conclusion that males are more likely to be physically active also held true for elderly people (70+) (Edjolo et al. 2013). Another study, while lacking statistical significance, in contrast found more females reporting regular exercise per week (Jaarsma et al. 2004), while according to Njelekela et al. (2009) no significant gender difference in physical activity measured in the extra cost of energy per day (number of MET¹-hours/day) was observed (Njelekela et al. 2009).

Lifestyle modifications for the prevention of cardio-metabolic disease showed improvements in metabolic, lipid, inflammatory and hemodynamic parameters with the effect being independent of gender (Karalliedde et al. 2014a, b). It should be mentioned here that two journal articles were scrutinized, describing the same trial but with slightly different title descriptions and results, although the conclusions were the same.

Prevention regarding occupational risks referred to influenza vaccination uptake of clinical staff in the upcoming season, for which male gender was a significant predictor of non-immunization behavior (Askarian et al. 2009). Beyond that, there was no gender difference in the proportion of non-vaccination against rabies between male and female veterinarians (Jackson and Villarroel 2012). A significance test was performed. Furthermore, low precaution awareness rankings were significantly more likely to be found among male small and large animal veterinarians indicating less than ideal infection control practices (Wright et al. 2008).

Vaccination practices were not only limited to occupational indications, but also concerned a variety of general diseases [influenza, HPV (human papillomavirus), TBE (tick-borne encephalitis) and genital herpes]. No significant association between gender and coverage rates or frequency for influenza vaccination was found by Wu et al. (2013), while, as

mentioned above, male gender was a significant predictor of the intention not to be vaccinated against influenza next season according to Askarian (2009). Vaccination against TBE was overall higher among males than among females (due to occupational reasons), but for self-paid TBE vaccination uptake did not differ between genders (Grgic-Vitek and Klavs 2012). Therefore, the proportion of males and females who requested vaccination against TBE and paid for it themselves was similar and led to no gender differences among individuals (Grgic-Vitek and Klavs 2012). On the contrary, the attitude regarding vaccination against HPV showed gender differences with regard to payment in one study, with males less willing to receive HPV vaccination than females when having to pay for the vaccine at the regular price (Nan 2012). In terms of cancer prevention, males were more likely to accept the HPV vaccine if it prevented not only cervical cancer, but also the two main HPV diseases, genital warts and cervical cancer in women (Jones and Cook 2008). Females were also significantly more likely to accept an HPV vaccine that prevented both diseases (Jones and Cook 2008). Another study found no significant effect on vaccination acceptance against genital herpes and HPV by gender (Boehner et al. 2003).

Concerning dental health behavior, females were significantly more likely than males to use dental floss regularly (Matthews et al. 2004). In the same study, females were also significantly more likely than males to gather health-related information (Matthews et al. 2004).

With regard to nutrition, females were significantly more likely to report fiber intake than males and to be aware of its health benefits (Mohr et al. 2010).

While the demand for mental health resources did not differ significantly among gender, Takusari et al. (2011) still found the percentage of males who had used them was significantly lower. Therefore, a significance test was performed, but no percent values were available.

Discussion

Gender differences in preventive behavior have long been the subject of discussion, and their perceived effects continue to influence public discussion as well as actions considered by healthcare systems in their efforts to counteract the rise of chronic diseases. For example, the new German Preventive Health Care Act gives special consideration to gender-specific differences and the need to tailor preventive measures more directly to males or females in order to enhance their efficiency (PrävG 2015). To scientifically back up ‘common knowledge,’ this review sought to explore gender differences in primary prevention behavior. The extent to which an evidence base exists for these recommendations is unknown, which calls for more investigation and raises questions pursued in this review.

¹ MET = metabolic equivalent, e.g., amount of oxygen consumed while at rest, approximately 3.5 ml O₂ per kg body weight per min. The energy cost of a physical activity is expressed as a multiple of the resting metabolic rate (Jette et al. 1990).

First and foremost, this study showed that despite the attention this issue receives, studies concerning the individual subtopics are scarce and quite diverse. Although the literature search yielded a fair amount of data with 23 original studies and 5 reviews after the year 2000, the small number of studies per specific content area makes it difficult to draw meaningful conclusions in any given field. Additionally, the results reflect huge content-related and qualitative differences between the studies. The number of studies concerning the same primary prevention subtopic was never higher than five or six. Other than that no more than three studies on one single topic were identified. A review or study on the utilization of primary prevention among genders as a whole could not be identified. Although it is possible that some studies on gender differences in health behavior were missed by our literature search, this rather limited data basis still surprises. Even before confining our study period to the year 2000 and later, no other trend was detectable. Some subtopics like sexual behavior and sun protection showed a better level of exploration, but most other subtopics were still scarcely investigated, and attempts to deduce an overall picture are lacking. Due to the use of cross-referencing and a search strategy that was precisely tailored to the topic question, we feel it is unlikely that any major relevant publications were neglected for consideration. This raises doubts about the reliability of the scientific background for the demanded actions. When summarizing all the subtopic-specific conclusions for the bigger picture in primary prevention, the female gender generally tends to encourage more and better preventive behavior, except for physical activity. In other subtopics males only showed more favorable behavior in some of the prompted subitems (e.g., wearing hats/clothes in the sun, sunbathing or condom use; see Table 4).

Limitations

However, some universal as well as distinct limitations have to be considered when appraising the results. First of all, the cross-border comparison of results is at least questionable as even within the different European countries social and cultural differences that influence behavior may exist. Social networks, religion, the female cultural role, income, unemployment, level of education, country-specific health politics and migration immediately come to mind. These differences become even more pronounced when comparing developing or newly industrialized countries. In addition, the participation rates of males and females differ strongly in some studies and can include more than two-thirds of either gender (Fernandez-Esquer et al. 2004; Jackson and Villarreal 2012; Matthews et al. 2004; Sax et al. 2007). Despite control and adjustment for the differences in sex distribution, an influence cannot be totally dismissed. As a rather high number of publications was added by cross-referencing, it may be asked why they were

not identified by the initial literature search. This might be the case because gender differences were not the primary focus of some of those studies but instead constituted incidental findings, causing results not to be coded in key words or MeSH terms. Also a general problem with searching the literature databases is to strike the right balance between maximizing the recall (quantity) and the precision of a search. When checking MEDLINE for the main terms such as “primary prevention,” “gender differences” and a combination thereof (>2000 to >25,000 hits), this resulted in a very high quantity of retrieved articles that seemed to miss the necessary relevance and quality to proceed. Therefore, the search strategy had to be tailored to more precisely reflect the topic in question. This restriction in the number of search results may be a limitation of the study, but 56 identified publications, before confining the study period for the sake of topicality, is a good output. However, the retrieved results still failed to show substantial and reliable conclusions on fundamental gender differences in primary prevention but focused instead on individual subtopics.

Topic-specific limitations such as embarrassment when talking about sex or a male desire to be seen as the ‘stronger sex’ have to be considered as well. Therefore, the deduced conclusions cannot be taken for granted. Also, the included studies were largely of a cross-sectional nature and mostly failed to examine interventions that may have been delivered in a gender-specific context.

SWOT analysis

A SWOT analysis is useful in assessing the scope of this review and highlighting different aspects. A SWOT analysis is usually used for strategic planning in the military or business world but also helps to evaluate the risks and options in other areas methodically by looking at Strengths, Weaknesses, Opportunities and Threats. One major strength lies in the systematic approach to the topic. To our knowledge, no study exists that has specifically examined gender differences in regard to primary prevention behavior as a whole. Therefore, we tried to bring together the evidence accumulated so far to shed light upon a scientific basis that could serve as the foundation for making an informed decision. Additionally, internationally accepted search methods were generally used for the systematic literature research. However, representing a weakness of this work, it has to be noted that we did not conduct searches on each separate subtopic but looked for a more general overview concerning gender differences in the wide field of primary prevention. By focusing on each individual topic and tailoring the search strategy to its needs, a higher study count could therefore presumably have been found and used for a more detailed evaluation. The broad research approach of this study might not be ideally suited

for a systematic evaluation. Since our results do not suggest an exhaustive explored study situation, both opportunities and threats overlap. Without proven scientific data on gender differences in primary prevention, the actions implemented by healthcare systems might miss their recipients. If a preventive measure is tailored specifically to one gender but the effect to which and the reason why it could influence behavior is not understood, it might not appeal to patients or even show an adverse impact. On the other hand, it might not even be necessary to implement different preventive concepts for men and women, potentially saving healthcare systems a lot of time and money. The current situation therefore leaves potential for acquiring a better understanding of the underlying principles and requires further research.

Conclusion

To our knowledge, this is the first systematic review that tries to give an overview of gender differences concerning a variety of topics in terms of primary prevention. It transpired that overall, women are more likely than men to engage in health behaviors associated with primary prevention. Therefore, the current study situation suggests that differences between men and women do exist, but that the effect and conclusions to be drawn affecting appropriate measures to be initiated by healthcare systems and politics remain unclear. In this light further studies are needed to find more details on gender differences concerning each individual prevention topic as well as to promote a more general understanding of gender differences in primary prevention. Further knowledge will help to decide whether tailoring of preventive measures to gender-specific needs is required.

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Compliance with ethical standards

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