Preventing and controlling water pipe smoking: a systematic review of management interventions

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Abstract

Background: Water pipe smoking (WPS) is re-gaining widespread use and popularity among various groups of people, especially adolescents. Despite different adverse health effects of WPS, many of the WPS interventions have failed to control this type of tobacco smoking. This study was conducted to identify experienced management interventions in preventing and controlling WPS worldwide.

Methods: A systematic literature review was conducted. Electronic databases were searched for records which were published from beginning 1990 to August 2018. Studies aiming at evaluating, at least, one intervention in preventing and controlling WPS were included in this review, followed by performing the quality assessment and data extraction of eligible studies by two independent investigators. Finally, interventions that were identified from the content analysis process were discussed and classified into relevant categories.

Results: After deleting duplications, 2228 out of 4343 retrieved records remained and 38 studies were selected as the main corpus of the present study. Then, the identified 27 interventions were grouped into four main categories including preventive (5, 18.51%) and control (8, 29.62%) interventions, as well as the enactment and implementation of legislations and policies for controlling WPS at national (7, 25.92%) and international (7, 25.92%) levels.

Conclusion: The current enforced legislations for preventing and controlling WPS are not supported by rigorous evidence. Informed school-based interventions, especially among adolescents can lead to promising results in preventing and controlling WPS and decreasing the effects of this important social and health crisis in the global arena.

Keywords: Management interventions, water pipe, smoking, Tobacco control
Background
Tobacco smoking is one of the main preventable causes of diseases and deaths claiming the lives of 7.2 million annually around the world [1, 2]. Although cigarette smoking is the dominant form of tobacco use in many countries, Water Pipe Smoking (WPS) with other names such as hookah, shisha, narghile, argille, Goza, oriented pipe, hubble bubble, Mada’s and glaze base, accounts for a significant and growing share of tobacco use globally [3, 4]. In addition, WPS is a culture-based (there are some other types of tobacco smoking behavior) method of tobacco use [5] and its history goes back to 500 years ago in Middle East, North Africa and Asia. However, it has experienced a worldwide re-emergence since 1990 [6] and is regaining popularity among different groups of populations, especially in school and university students [7, 8]. Although WPS is most prevalent in Asia (specifically the Middle East region) and Africa, it has now been changed to a rapidly emerging problem in other continents such as Europe, North, and South America [9, 10]. In recent years, there has been 6–34% increase in tobacco use among 13–15 year old students, most of whom attribute to WPS [10, 11]. In European regions such as Latvia and Czech Republic 22.7 and Estonia 21.9% of people smoke water pipe, while in the Eastern Mediterranean region, the prevalence of WPS is 39.0 and 31.0% of boys and girls, respectively [12]. In average, Lebanon has the highest reported rate (37%) in this regard [12, 13]. In the United States, more than 30% of university students of both genders and 23% of high school students have experienced WPS [14, 15]. Similarly, WPS is also prevalent among highly educated groups. Nearly 20% of health professionals in Jordan and 11% of medical students in London smoked WP [16, 17]. Based on a report, 29.5% of physicians also experience WPS in Pakistan [18].

It has been shown that WPS' smoking rate can be more addictive compared to that of the cigarette. It also contains more toxic and carcinogenic substances [19, 20] with deleterious effects on the respiratory and cardiovascular systems, as well as oral cavity and teeth [21]. Furthermore, it has a huge negative impact on health costs and the gross domestic product of the countries. For example, the direct and indirect cost of smoking-related diseases is up to $300 billion in the United States annually [22, 23].

Considering the extension of WP businesses, some groups support its expansion [24]. In recent years, the number of WP cafes has increased over many countries. As an example, there are nearly 400 WP cafes in London [25].

Using deceptive advertising, many cafes and restaurants offer WP services along with their orthodox services in order to earn more profit and lure more customers. Moreover, several factors contribute to attracting children and adolescents to WP cafes that leads to an increase in new cases of WPS [26–28]. These factors include the provision of flavored tobacco products or psychotropic WP, the proximity of WP cafe to the public settings such as educational or residential settings, sports clubs, and residential areas, tempting decoration, the provision of study places for students, live music, a variety of games and gambling, and the possibility of watching live movie and sport matches [6, 25, 29, 30].

All this shows that WPS has been turning to a public health crisis. WP business has remained largely unregulated and uncontrolled, which may result in the increasing prevalence of WPS [31]. Moreover, WPS is one of the main factors that can lead to failure in tobacco control [32]. Despite the concerns about WPS outcomes and nearly three decades of using control measures, the prevalence of WPS has increased over the world. Due to the unique nature of WP (multi-components), little is known about the prevention and control of WPS [33]. Thus, special actions and interventions might be required to prevent and control WP tobacco use [33]. Over the recent decade, there has been growing interest among researchers and policymakers regarding addressing the gaps in knowledge about interventions that can be useful in controlling and preventing WPS. Accordingly, this study aimed to identify the management interventions in international and national levels for preventing and controlling water pipe smoking.

Methods
Study design
A systematic literature review was conducted. The Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) guideline [3] was used for performing and reporting the review.

Inclusion criteria
Primary studies aiming at evaluating, at least, one intervention in preventing and controlling WPS were included.

Population
WP consumers or people who are likely to be WP consumers in the near future.

Intervention
Activities, programs, or strategies at the management level aiming at preventing and controlling WP use.

Outcome
A categorized array of themes presenting a comprehensive picture of management interventions which are targeting WPS prevention and control.
Search strategy
PubMed, ISI Web of Science, Embase, Scopus, Science Direct, and Ovid were searched for published records from beginning 1990 to August 2018. Further, the first 10 pages of Google Scholar function, World Health Organization (WHO) and World Bank websites were also searched for relevant studies. Additional file 1 provides the terms and search strategy in PubMed.

Exclusion criteria
Studies were excluded if their focus were on various forms of tobacco use and not just WP use or if they did not distinguish WPS from other forms of tobacco use.

Quality appraisal
According to the type of the included studies, the critical appraisal checklists of the Joanna Briggs Institute [34] were used for quality appraisal. The Joanna Briggs Institute (JBI) is an international, membership based research and development organization within the Faculty of Health Sciences at the University of Adelaide. JBI Critical appraisal tools have been developed by the JBI and collaborators and approved by the JBI Scientific Committee following extensive peer review. These tools were preliminary for use in systematic reviews. Based on a scoring approach (number of “yes” answers divided by all questions), included studies were categorized to high, moderate, or low quality.

Data extraction
The data extraction parameters included author, year, country, study design and setting, type of study, participants, the level and type of interventions, study duration, sample size, and main outcomes.

Data synthesis
Management interventions which influenced controlling and preventing WPS were retrieved and categorized through content analysis method. The interventions were identified and categorized by two researchers (L. D. & J.B) using the following process.

1. Reading the selected records;
2. Identifying and extracting the related interventions after calibration to ensure consistency and accuracy;
3. Grouping the identified interventions into categories and sub-categories based on their conceptual similarity;
4. Solving disagreements between researchers by discussions. Whenever disagreement persisted the third author was approached. In some cases, the identified interventions were placed in more than one category;
5. Confirming categories and subcategories.

Results
The searching process resulted in 4353 studies with 2125(48.81%) of these being repetitions. Out of 2228 screened articles (after removing the duplicates), 38 articles were selected through on the title& abstract screening process. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram was used to show the number of records in each phase (Fig. 1).

The included studies were of moderate-to-high quality. The characteristics of included studies are provided in Table 1.

The selected studies were published between 1990 and 2018 and focused on 19 different countries including the United States (13.15%) [6, 29, 30, 35, 36], the United Kingdom (7.89%) [25, 37, 38], Germany (5.26%) [12, 39], Iran (5.26%) [40, 41], Egypt [42, 43] (5.26%), Malaysia (2.63%) [44], India (2.63%) [45], Dutch (2.63%) [46], Pakistan (2.63%) [47], Qatar (2.63%) [48], Jordan (2.63%) [16], Lebanon (2.63%) [49], Syria (2.63%) [50], Turkey (2.63%) [51], Bahrain [52] (2.63%), Israel (2.63%) [53], the United Arab Emirates (2.63%) [29], Saudi Arabia [54](2.63%), and Switzerland (2.63%) [55]. Additionally, the type of study design included cross-sectional (31.57%), quasi-experimental (15.78%), and qualitative types (23.68%).

Seventy eight management interventions were identified. After combining interventions with similar concepts into one category, the total number of exclusive interventions condensed to twenty seven.

In the next step, the interventions were assigned to four main subcategories including preventive interventions (18.51%) [12, 35, 40, 44, 46, 48, 54, 56] and control interventions (29.62%) [25, 30, 37, 45, 57, 58], as well as interventions at the international (25.92%) [6, 29, 39, 43, 44, 51, 53, 59, 60] and national (25.92%) [10, 16, 25, 30, 46, 49, 51, 57, 61, 62] levels. The details of the included interventions are presented in Table 2.

Discussion
In this study, the management interventions affecting the prevention and control of WPS worldwide were identified through a systematic literature review. In this regard, 27 interventions were experienced in the world for WSP control that was categorized into four main themes and four sub-themes.

Preventive interventions
Preventive interventions refer to measures that their focus is on abatement of WPS consumption. Some studies suggested that more evidence and investigations are needed to prevent and control WPS [33, 38, 65, 66]. Lopez et al. found that evidence related to WPS control is very rare, and more investigations and studies are required in this respect [33]. Some other studies were related to the
current interventions for the prevention and control of WPS that were incompatible with the various needs of the new generations of adolescents. They are poly-users, occasional and social users, and have fast access to new products via the web [5, 44, 67].

To prevent WPS, most studies focused on school-based educational interventions [68]. In many countries, first time smoking occurs in school students and adolescents [69], and students are considered as the current water pipe smokers [12, 41, 46, 48, 54, 55, 70, 71]. For example, the rapidly growing prevalence of experiencing WPS among younger age groups in Lebanon, is going to be considered as an epidemic phenomena [72, 73]. The younger generations have always been lured by fancy advertisements in the media. There have easy access to water pipe bars and are under the illusion and medical myth that the passage of smoke through the water in water-pipes “purifies” the smoke of all harmful elements [74].

NidalEshah et al. (2017) showed that more than 70% of smokers begin WPS in adolescence [75]. In fact, in many countries, young and adolescents’ easy access to café which are providing water pipe facilitates, make them prone to try WPS out [31]. Studies conducted by Aboaziza (2015), Stamm-Balderjahn (2012), and Tugay (2012) revealed that many adolescents become dependent after the first use of WP, which makes the quitting process extremely hard and the educational programs less effective [12, 19, 76]. Thus, access restriction regulations in the time of licensing and controlling their services can be considered as potential intervention.

**Control interventions**

Control interventions are activities that try to reduce WPS consumption. The lack of WPS control interventions among students has been reported. Harvey and Phan Thu, P (2016) confirmed that health care professionals have a key role in WPS prevention and control [10, 77]. In a study conducted by Moyer VJP (2013), health care professionals were found to be helping adolescents to change their behavior [78]. On the other hand, Kumar et al.(2015) reported that the prevalence of WPS among health care professionals, especially medical and nursing students [79], can act as a positive vision to WP and cause low motivation to cooperate in WPS control programs [80, 81].

Public education about high-risk behaviors such as WPS was another experienced intervention. Social media, the Internet and mass media are the main factors in promoting or preventing WPS among adolescents.

In recent years, WPS has become a common social behavior and recreation and it is a catering item in many familiar parties. Social acceptance and being an essential part of the family, peer, and public gatherings and café and restaurant culture are highly influential factors contributing to the growth and its popularity. Therefore, exploring the general public’s knowledge and attitude toward WPS is useful in designing and formulating appropriate interventions in controlling WPS [74]. Further, communication and dissemination strategies to facilitate the use of health-related evidence regarding the WPS
| Author/Year | Country       | Design                   | Setting          | Method                | Target group                  | Intervention                                                                 | Study duration          | Sample size | Outcome                                                                 | Quality  |
|------------|---------------|--------------------------|------------------|-----------------------|------------------------------|--------------------------------------------------------------------------------|-------------------------|-------------|--------------------------------------------------------------------------|----------|
| Lock 2010  | United Kingdom| Qualitative              | Community       | Interviews            | WP smokers                   | Smoke-free legislation (SFL)                                                   | 2007                    | 32          | Increase of private smoking                                              | Moderate |
| Highet G. 2011 | United Kingdom| Qualitative              | Community       | Interviews            | WP smokers                   | Implementation of the smoke-free law                                          | April 2007–December 2008 | 120         | Increase of WPS                                                          | Moderate |
| Jawad M. 2013 | United Kingdom| Qualitative              | Universities    | Interviews            | Regular water pipe smokers   | Dispel the misconception about WPS                                            | January–April 2012      | 32          | Decrease of WPS                                                          | Moderate |
| Jawad M. 2014 | United Kingdom| Qualitative              | Community       | Interviews            | Local authority staff         | Use the experiences of executive authority                                    | May–June 2013           | 26          | Identifying executive problems.                                          | Moderate |
| Mohd Zin F. 2016 | Malaysia     | Qualitative              | Schools         | Semi-structured interviews | Adolescents                | Developing new interventions                                                  | 2015                    | 40          | Urgent need to new interventions                                       | Moderate |
| Grant A. 2016 | United Kingdom| Exploratory qualitative  | Tweets          | Documentation         | No human subjects            | Prevention of web advertising                                                | Jul-05                  | 4439 tweets  | WP smoking as an enjoyable activity and a challenge for public health.  | Moderate |
| Colditz J. B. 2017 | United States | Qualitative              | Web sites       | Documentation         | No human subjects            | Implement of existing tobacco control policies                              | April–July 2013         | -           | Current interventions are old                                            | Moderate |
| O'Neill N. 2017 | United Kingdom| Qualitative              | Email            | Modified Delphi Technique | Experts and scientists of behavioral science | Developing of behavior change techniques                               | Jul-05                  | 24          | Effective interventions in quit of WPS                                | Good     |
| Mostafa A. 2018 | Egypt        | Qualitative              | Community       | Interviews            | Men and women ≥18             | Append of placing pictorial health warnings on WP devices                     | 2015–2016               | 90          | Effective interventions in WPS prevention and stop                       | Moderate |
| Anjum Qudsia 2008 | Pakistan | Cross-sectional          | School           | Pre& post-tested      | School students 14–19 years old | Health messages                                                               | 2006                    | 646         | Improving knowledge of the students                                     | Moderate |
| Shishani K. 2011 | Jordan    | Survey                   | Hospital         | Questionnaire         | Nurses and physicians in WPS control                                        | 2010                    | 918         | Low incentive and skill to cooperate in WPS control programs.           | Moderate |
| Salloum R. 2013 | Lebanon      | Cross-sectional          | Household        | Questionnaires        | Adults                        | Increasing taxes                                                              | 2005                    | 13,003      | Decrease of WP tobacco demand                                           | Moderate |
| Ali Quadri M. F. 2014 | Saudi Arabia | Cross-sectional          | Community       | Questionnaire         | Students 15–25 years          | Improving the knowledge                                                      | 2013                    | 1051        | Increasing knowledge                                                    | Moderate |
| Kasem N. O. F. 2015 | United States | Cross-sectional          | University       | Questionnaire         | Undergraduate student ≥18     | Prohibiting from opening in close to educational places                      | Spring 2007             | 1332 United States | Effective in WPS                                                        | Good     |
| Erdöl C. 2015 | Turkey       | Survey                   | Community        | Questionnaire         | Adults ≥15 years              | Increasing of excise taxes and size of pictorial health warnings              | June–October 2014       | 367         | Decrease of demand for WPS by youth.                                     | Good     |
| Babaie et al. BMC Public Health (2021) 21:344 | United States | Survey (Internet)        | University       | Questionnaire          | University students> 18 old      | Control fruit-flavored and sweet tobaccos                                    | June–October 2014       | 9030 and 9851 | Decrease of demand for WPS by youth.                                     | Good     |
| Author/Year | Country       | Design                  | Setting                  | Method                  | Target group | Intervention                                                                 | Study duration | Sample size | Outcome                                      | Quality  |
|------------|---------------|-------------------------|--------------------------|-------------------------|--------------|-------------------------------------------------------------------------------|----------------|-------------|----------------------------------------------|----------|
| Islam F. 2016 | United States | Cross-sectional survey | University              | Questionnaire           | university smokers students smokers > 18 | Appendix of warning labels                                                   | June–October 2014 | 367          | Effective to control WPS                    | Good     |
| Kingsbury J. H. 2016 | United States | Cross-sectional       | Community                | Questionnaire           | Adults ≥18    | Control of occasional and group smokers                                        | 2014           | 242          | Effective to control WPS                    | Good     |
| Smith D. M. 2016 | United States | Cross-sectional       | Telephone-based          | Interview               | smokers ≥18   | Prevention of first use fruit-flavored and sweet tobacco                       | November 2012–April 2013 | 1443         | More effective in being non user           | Moderate |
| Jaam M. 2016 | Qatar         | Cross-sectional       | Community                | Interviews              | WP smokers    | Empowering the families                                                        | July–October 2013 | 181          | Decrease of WTS                             | Moderate |
| Riggs N. R. 2016 | United States | Survey                 | School base              | Questionnaire           | School students | Inhibitory Control and Free Lunch                                               | 2015           | 407          | More effective in prevention of WPS         | Moderate |
| Jawad M. 2017 | Germany       | Cross-sectional       | WP Fair of International | Observation             | Tobacco products | Control of packaging and labelling with guidelines                              | Jul-05         | 35           | More effective in prevention of WPS         | Moderate |
| Hamadeh R. R. 2017 | Bahrain     | Cross-sectional       | Quit clinics             | Interview               | Male patients smokers | Drugs treatment along with counseling                                          | August–December 2015 | 194          | Effective in quit                           | Moderate |
| VanDeaverter N. 2017 | United States | Cross-sectional       | Web-based                | Questionnaire           | nursing students | Training of patients by nurses                                                  | February–April 2014 | 820          | Effective in decrease of WPS                | Good     |
| Joudrey P. J. 2016 | US-UAE      | Cross-sectional       | Businesses               | Observations and interviews | business owners or managers | control of marketing                                                            | January–March 2014. | 97           | Need to WP-specific legislation.            | Moderate |
| Kowitt S. D. 2017 | United States | Survey                 | Community                | Checklist               | smokers ≥18   | Use of FDA Regulation for WP                                                   | September 2014 to August 2015 | 1520         | More effective to quit                      | Good     |
| Deshpande A. 2010. | India        | Pre & post test        | Hospital venues          | (PM2.5) measurements   | No human subjects | Implementation of the smoke free law in hospitality settings                  | 2008–2009       | 25           | Decrease of WPS                            | Low      |
| Lipk Isaac M. 2011 | United States | Randomised controlled | Web-based                | Questionnaire           | University students | Educational interventions of online for colleges' WP smokers                  | 2009–2010       | 91           | Decrease of WPS                            | Moderate |
| Stamm-Balderjahn S. 2012 | Germany    | Quasi-experimental    | Hospital                 | Questionnaire           | High school students | Educational interventions in clinical settings.                               | September 2007–July 2008 | 760          | Effective in prevention of smoking         | Moderate |
| Mohlman M. K. 2013 | Egypt        | Quasi-experimental    | Community                | Interviewer             | General population | Educational and behavioral interventions                                        | 2005–2006       | 5934         | Increase in the attitudes that WP is harmful | Moderate |
| Asfar T. 2014 | Syria         | Randomised controlled | clinical                 |                          | Adults ≥18   | Brief behavioral interventions clinical settings.                            | November 2007–October 2008 | 50           | Effective in being none smoking            | Moderate |
| Tomaszek S. 2014 | Switzerland   | Quasi-experimental    | Hospital                 | Questionnaire           | School students | Brief behavioral interventions by lung specialists.                           | 2009 - February 2013 | 470           | Effective in prevention of school students smoking. | Moderate |
| Author/Year | Country | Design       | Setting          | Method            | Target group    | Intervention                                                                 | Study duration | Sample size | Outcome                                      | Quality |
|-------------|---------|--------------|------------------|-------------------|-----------------|-------------------------------------------------------------------------------|----------------|-------------|---------------------------------------------|---------|
| Essa-Hadad  | Israel  | Quasi-experimental | Web-based mixed-methods | Students | Web-based education programs | 2007–2010 | 225        | Decrease of WPS                              | Moderate |
| Little M. A. | United States | Interventional | Military | questionnaire | Air Force trainees | Brief Tobacco Intervention | October 2014–March 2015 | 1055       | Increase of knowledge                        | Moderate |
| Rozema A. D. | Dutch  | Quasi-experimental | Schools questionnaire | School students | Outdoor school ground smoking bans | 2014–2015 | 7733       | Effective in prevention of WPS               | Moderate |
| Momenabadi V. | Iran   | Quasi-experimental | Dormitory questionnaire | Students | Educational intervention: BASNEF model | 2014 | 80         | Improving of attitudes that WP is harmful  | Low     |
| Mahoozi S. | Iran    | Semi-experimental | Medical and hygienic centers questionnaire | women | Education of women in health center | November 2015–October 2016 | 60         | Improving attitudes that WP is harmful      | Moderate |
| Leavens E. L. S. | United States | RCT | WPS settings questionnaire | smokers ≥18 | Testing exhaled carbon monoxide (CO) before and after and personalized feedback | August–December 2014 | 109        | Effective in quitting WPS                  | Moderate |
alongside the role of community health workers, especially in the resource-poor and underprivileged areas of the society and agencies involved in raising public awareness on this issue are essential to be considered [82, 83].

**Enactment and implementation of legislatives and policies in international level**

According to the study findings, the WHO Framework Convention on Tobacco Control (FCTC) is a global treaty enacting the actions to control all tobacco products [84]. However, controlling cigarettes and WP-specific actions has received less attention among national policies, and it just has been applied in some studies [85, 86]. It has been shown that using the proposed actions by the FCTC to manage WPS can lead to progress in its prevention and control [51].

Despite the WHO FCTC Article [87] on the taxation of all tobacco products, WP products are still tax-exempt. Although, some studies reported the effectiveness of taxation in reducing tobacco smoking [48, 49, 86], cheap or expensive prices may not be effective in WPS [48, 88]. Several studies suggested that executive authorities have main roles in controlling WPS and should be supported by legislative enforcers and policymakers [25, 30, 89].

According to different studies, the lack of proper interventions in WP industry, including packaging, labeling, advertising, fruit-flavored and sweet tobacco, settings, and diversified services can lead to a failure in WPS control programs [6, 29, 30, 43, 44, 59, 60]. Other studies represented that there is a strong relationship between fruit-flavored and sweet WP tobacco products and the expansion of WP use and act as the main barrier for WPS control [90, 91]. Therefore, measures to ban these additives proposed to be considered [6, 92, 93]. Furthermore, previous evidence shows that proper warning labels accompanied by a clear and intelligible packaging can be more effective in controlling WPS [25, 43, 51, 94, 95].

| Table 2 Effective Interventions in Preventing and Controlling Water Pipe Smoking |
|----------------------------------|----------------------------------|
| **Main Category** | **Interventions** |
| Preventive interventions | 1-Community-based informing interventions [1–4]  
2-College-based education [1, 5, 6]  
3-Decreasing social acceptability and occasional smoking [4, 7]  
4-Empowering the adolescents and families [8–10]  
5-School-based continuous education [11–15] |
| Control interventions | 1-Controlling WP industry marketing [16]  
2-Enforcement of new FDA rules [17]  
3-Coordinated enforcement of WPS control in adjacent area [18]  
4-Involving policymakers to support executive authority in WPS control [19]  
5-Licensing and control of all none-WP activities [18]  
6-Reducing youth access to WP locations and products [63]  
7-Strong implementation of current legislations [20–22]  
8-Using successful experiences of authority in WPS control [18] |
| Enactment and implementation of legislatives and policies on international levels | 1-Monitoring activities of WP industry marketing and designing proper control measures [16, 23]  
2-Compulsion of industry to append evidence-base health warning labelling in proper places and sizes in WP device, accessories, and other products [24–27]  
3-Developing evidence-based control programs tailored to the needs of new generation [9]  
4-Encouraging scientists to develop effective interventions of WP control for policymakers [28]  
5-Compulsion of industry to decrease the production of various fruit-flavored and sweet tobaccos [29, 30]  
6-Preventing social pages and websites from deceptive advertising [31, 32]  
7-Developing WP-specific new and clear actions [9, 33] |
| Enactment and implementation of legislatives and policies on national levels | 1-Restricting WP settings [12, 19]  
2-Determining proper taxation for WP tobacco packs, devices, and all products [27, 63, 64]  
3-Monitoring consumption of medical and nursing students and health care professionals for designing control measures [34]  
4-Involving health care professionals to cooperate in the WPS control program [35, 36]  
5-Offering evidence-based counselling knowledge about WPS control to health professionals [37]  
6-Improving quality of training curricula and informing medical sciences students about WPS control [35]  
7-Encouraging executive authorities in developing innovative ways of WPS control [17, 18] |
Enactment and implementation of legislatives and policies in national level

Although there are extensive WPS restrictive rules in countries [65], the lack of coordination between the involved organizations and the lack of executive support have led to their inefficiency [96]. Community involvement and advocacy were found among the strongest WPS prevention measures [97, 98]. Moreover, community representatives, local and identical groups, and local community centers advocacy had shown some extend of efficacy as management interventions [99].

Some researchers believe that smoking related harms could not be completely prevented. Therefore harm reduction strategies were proposed in studies [100]. Although, those strategies might be interesting for hookah [101]. Recently, three harm reduction components (quick-light charcoal, electric heating and bubble diffuser quick-light charcoal and bubble diffuser) have been examined [102], however such strategies are not yet agreed upon and needs some more evidences [100].

Strengths and limitations of the study

Although this study was not aimed to evaluate interventions and provide some information about their efficacy, summarizing the intervention effects across themes would be valuable. However, we could not find well-defined interventional studies using a common evaluation means. Additionally, most found interventions were complex interventions with a variety of components making the synthesis of intervention effects more challenging.

Conclusion

In general, our findings indicated WPS related social and health crisis have not come into attention in high levels of decision making. The current enforced legislations are old, unclear, and incompatible with the needs of the adolescents and are not backed by rigorous evidence. In addition, the WP industry is rapidly expanding without monitoring and controlling measures. Informing and empowering adolescents for those who have not yet experienced smoking is a sensible intervention in this regard. Besides, empowering and involving health students and professionals in WPS control programs can lead to promising results in preventing and controlling WPS. It seems that there is a paucity of evidence regarding strategies on controlling and preventing WTS, thus further research in the society is warranted in this respect.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-021-10306-w.

Additional file 1.

Abbreviations

WPS: Water Pipe Smoking; WP: Water Pipe; GDP: Gross Domestic Product; WHO: World Health Organization; FCTC: Framework Convention on Tobacco Control

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Authors’ contributions

GA collected and reviewed the papers and analyzed and prepared the Figs. LD contributed in designing, analyzing, drafting and finalizing the paper. JB contributed in categorizing of factors, developing the framework, and reviewing. AA analyzed and critically revised the manuscript for important intellectual content. All authors read and approved the final version of the paper.

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Availability of data and materials

All of the included papers are available in PubMed, ISI Web of Science, Embase, Scopus, Science Direct, and Ovid databases.

Ethics approval and consent to participate

This study reviewed and approved by Tabriz University of medical Sciences research ethical committee. Ethical code: IR.TBZMED.REC.1397.115.

Consent for publication

Not applicable.

Competing interests

The authors state they have no conflict of interests to declare.

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