Heliyon 10 (2024) e30090

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Training in preconception care focused on primary health care providers: Effects on preconception care knowledge and provision

Natália de Castro Nascimento [a], Ana Luiza Vilela Borges [a,*], Elizabeth Fujimori [a], Belarmina Reis-Muleva [b]

[a] *Public Health Nursing Department, School of Nursing, University of São Paulo, Av. Doutor Enéas de Carvalho Aguiar, 419, 05403-000, São Paulo, SP, Brazil*

[b] *Lúrio University of Nampula, Mozambique, Bairro de Marrere, R Nr. 4250, Km 2,3, Nampula, Mozambique*

A B S T R A C T

Objective: To assess the effect of a rapid training intervention on the knowledge of health providers and the provision of preconception care in primary health care services.

Methods: Randomized community trial in eight primary health care facilities (four were randomly allocated to the intervention group and four to the control group) in 2020 in Brazil. The intervention consisted of rapid training in preconception health for all health providers in the intervention group. Health providers who had medicine and nursing backgrounds answered structured questionnaires about their knowledge and practices of preconception health-related topics, and reproductive-age women attending the services completed a questionnaire about their experience with preconception care in pre- and postintervention (three months after the intervention) periods.

Findings: The level of knowledge among health providers increased after the intervention, but providing information about preconception care and prescribing folic acid showed no significant change, with the exception of screening for future pregnancy intention.

Key conclusions and implications for practice: Although the knowledge of health providers on preconception care is a fundamental requirement for its provision in primary health care settings, rapid training focused on preconception health topics was not sufficient to change their practices, with the exception of pregnancy intention screening, which experienced a slight increase after the training. It appears that additional elements, such as the reorganization of primary health care services to prioritize non-pregnant women, the development and implementation of specific guidelines, along with strategies for the dissemination of preconception care awareness, may also play crucial roles for full preconception care implementation in addition to health providers' knowledge of such issues.

1. Introduction

Preconception care consists of a set of health initiatives to enable women and men of reproductive age to experience pregnancy in a healthier way to achieve the best maternal and child health outcomes and consequently end preventable maternal and child mortality [1–3]. It comprises but is not limited to nutritional assessment, the screening and management of genetic conditions and infertility, tobacco and alcohol use cessation, immunization, mental health promotion, the use of folic acid before conception, and the prevention of pregnancy in short interpregnancy intervals, among other programmes [1].

There are plenty of opportunities in primary health care services to implement preconception care in every health care visit [4]. However, preconception care has not been a priority, and other interventions seem to have greater importance in primary health

* Corresponding author. Public Health Nursing Department, School of Nursing, University of São Paulo, São Paulo, Brazil. Av. Doutor Enéas de Carvalho Aguiar, 419, 05403-000, São Paulo, SP, Brazil.

E-mail addresses: nacastron00@gmail.com (N. Castro Nascimento), alvilela@usp.br (A.L.V. Borges), efujimor@usp.br (E. Fujimori), belarminareis@gmail.com (B. Reis-Muleva).

https://doi.org/10.1016/j.heliyon.2024.e30090
Received 17 February 2023; Received in revised form 31 March 2024; Accepted 19 April 2024
Available online 28 April 2024

services [5,6], such as antenatal care, when the pregnancy has already happened. In fact, the literature shows that there is little provision of preconception care for women of reproductive age in many low- and high-income countries [7–10].

The low level of knowledge of preconception care among health providers is one of the reasons for its low or even no provisions [7,8,11]. Providing specific training can expand the provision of preconception care by health providers and, consequently, expand the awareness and adoption of preconception measures by women and couples [12].

Studies that assessed the effects of training in preconception care for health providers and health science students showed an increase in the level of the knowledge on the topic [13–15] and in the provision of preconception care [14,16], mainly because they felt more prepared to do so [17]. However, these studies were conducted only in high-income countries, and there is no mention of whether there was a control group for comparison [13–18].

Given the importance of preconception care for maternal and child health [1], the low level of knowledge on the topic among health providers, and its insufficient provision in primary health care services, we assessed the effect of a rapid training intervention on the knowledge of health providers and the provision of preconception care in primary care health services.

This study was carried out in Brazil, a middle-income country in Latin America. The landscape of preconception care in Brazil does not differ significantly from that of other countries. While primary health care has evolved with positive effects on population health, the rate of improvement has not been the same for maternal health. The country still struggles with high maternal mortality rates, poor quality of antenatal care, and a high proportion of unintended pregnancies [19]. Additionally, Brazil lacks national data on preconception health, but local studies have observed that only a few women use folic acid before conception, and even women with planned pregnancies face difficulties in accessing preconception care [20]. Identifying whether the improvement in the knowledge of health providers about preconception care increases its provision in primary health care services could guide the implementation of effective preconception care tailored to reproductive needs, not only in Brazil but also in other countries.

2. Methods

This was a randomized community trial conducted in primary health care facilities (PHCFs) in São Paulo city, Brazil (registered at the Brazilian Registry of Clinical Trials number RBR-4qgwpq, code U1111-1254-7700). The sampling units were 8 PHCFs, calculated from an analysis of variance model (ANOVA - model of mean comparisons for repeated measures) and considering a change of 40 % in preconception care provision [21], a test power of 95 % and a type I error of 5 %. Among a list of 12 PHCFs from a specific low-income region in the city, we randomly allocated four PHCFs to the intervention group and four PHCFs to the control group.

The Brazilian health system is characterized by universal coverage and provision of free health care services. Since 1994, primary health care has been structured around the Family Health Strategy, leading to significant improvements in various health indicators, including the infant mortality rate, antenatal care coverage, immunization rates, and the prevention of chronic diseases. The delivery of primary health care services is carried out by multidisciplinary family health teams, each tasked with caring for a specific, limited territory-based population. These teams consist of one doctor, one nurse, two auxiliary nurses, and six community health agents, together covering approximately 65 % of the population [22]. In the present study, both the intervention and control PHCFs had 20 family health teams each.

To evaluate the impact of a rapid training intervention on the knowledge of health providers and the provision of preconception care in the PHCFs, we investigated two populations: health providers, as they deliver preconception care, and women of reproductive age, who are the primary recipients of preconception care services. Since the commencement of this study, men were not included as participants due to challenges in locating reproductive-aged males during the operating hours of PHCFs.

All health providers who had medicine and nursing backgrounds from the eight PHCFs were invited to take part in the study (83 workers, considering that there was employee turnover, annual leave, and resignation). They were aware of the study objectives, methodology and which group they were allocated to. Their participation consisted of taking part in three stages of the study: 1) completion of a structured instrument about their sociodemographic characteristics, work experience, knowledge of preconception care and routine of preconception care provision; 2) participation in the training; and 3) completion of the same instruments again three months after the training.

Concerning women of childbearing age (18–49 years of age), a random sample of one out of every five women who attended the PHCF on a monthly basis was invited to take part in the study to report their experiences in accessing preconception care. The minimum sample size required for the sample was calculated by taking the proportion of preconception measures adopted by women of the same age in another Brazilian study as a parameter [20], proposing an increase to 30 %, a test power of 95 % and a type I error of 5 % ($n = 226$ women before and 226 after the intervention, or a total of 452 women, separated by intervention and control group, which means that 113 women should be interviewed in the control PHCFs and 113 in the intervention PHCFs before the intervention and the same number should be interviewed after the intervention). Their participation consisted of taking part in two stages of the study: 1) they completed the questionnaire in the week before the intervention and 2) three months after. The women who completed the questionnaire before the intervention were different from the women who completed after the intervention.

The intervention consisted of a rapid training (1-h duration) that addressed the main and essential topics of preconception health, such as the definition and guidelines of preconception care; preconception care topics such as nutrition, tobacco and alcohol use, genetic issues, mental health, the prevention and control of chronic diseases, and fertility screening; and the benefits and barriers for its implementation. The training also emphasized the necessity of assessing pregnancy intention during every interaction with women and couples of reproductive age, using a straightforward question: "Do you have plans to become pregnant soon?". It was designed based on the preconception health care model recommended by the World Health Organization (WHO) and the Brazilian Ministry of Health (MOH) [1,23]. All trainings were conducted by the first author. After the study, rapid training was also offered to the health

providers in the control PHCFs.

Data collection was performed from April 2019 to January 2020. All instruments were created by the group of researchers and were structured and pretested (self-administered to the health providers and completed by the women with the help of interviewers) (Supplementary Files 1 and 2). The instrument used to compare the health providers' knowledge of preconception care before and after the intervention was a 13-statement questionnaire with three response options (agree, do not agree and do not know). Statements were expanded based on previous literature review and the guidelines of the Brazilian MOH. The answers considered correct were coded with a value of 1, and the answers considered incorrect, together with the "do not know" answers, were coded with a value of 0. The sum of the correct answers formed a score, which could vary between 0 and 13. Thus, the higher the score, the higher the level of knowledge of preconception care. No psychometric approach was taken to assess the validity and reliability of such instrument as this was not elaborated with the purpose of developing a validated scale on the knowledge of preconception care.

To compare preconception care provision, we assessed the routine preconception care provision by health providers pre- and postintervention. They were asked to fill out a structured instrument and report if they, on a routine basis, screened future pregnancy intention, disseminated information about preconception care, provided information about preconception care after a rapid pregnancy test and prescribed folic acid before conception. The responses "never" and "rarely" were categorized as "no" (coded as 0), while the responses "occasionally" and "always" were categorized as "yes" (coded as 1).

We also assessed whether women attending the PHCFs were asked about their future pregnancy intention in the previous year, if information about preconception health was shared with them during medical consultations, if Pap smear tests were performed, if vaccination or other health group meetings were provided, if they were ever counseled about preconception measures and if they had been prescribed folic acid before a pregnancy (if they had been pregnant in the three previous months or if they were pregnant at the time of the interview). All answer options were dichotomous, allowing respondents to choose between "no" or "yes" for each question. These reports were assessed before and three months after the intervention.

The outcomes were the effect of the training on health workers' knowledge of preconception care and provision of preconception care.

All outcomes were compared before and after the intervention and between the intervention and control groups. We analyzed data using R Program, version 3.6.2., in four steps: 1 – Description of sociodemographic characteristics, training backgrounds, and professional experiences of the health providers, stratified by intervention and control group (age, sex, profession, years of professional experience, years of time working in primary care) and presented as numbers and percentages. Numerical variables were compared using Wilcoxon and Mann–Whitney tests and categorical variables were compared using Chi-square and Fisher's exact tests; 2 – Analysis of the knowledge of preconception care, stratified by intervention and control PHCFs and pre- and postintervention: the mean score was compared using the mixed effects model; 3 – Description of sociodemographic and reproductive characteristics of the women, stratified by intervention and control group (age, self-identified skin color, union jobs, paid jobs, health insurance, economic classification, age at menarche, age at first sexual intercourse, age at first pregnancy, previous abortions, number of pregnancies and number of children). Skin color was measured by the question "how do you self-classify your skin color?", which is standardized by the Brazilian Census Bureau and mandatory in data collection instruments in health services and epidemiologic surveys in Brazil [24]. There are five options of responses to this question: white, mixed (or "pardo" in Brazilian Portuguese, which could also be translated as brown), black, yellow (Asian origin) and indigenous. These characteristics were presented as numbers and percentages and compared using Wilcoxon and Mann-Whitney tests for numerical variables and Chi-square and Fisher's exact tests for categorical variables; and 4 – Analysis of preconception care provisions, stratified by intervention and control group using longitudinal logistic regression. The statistical level of significance was considered a $p < 0.05$.

This study was reviewed and approved by the Sao Paulo City Health Board and the University of Sao Paulo School of Nursing Institutional Review Boards, with the approval numbers 3269514 and 3167031, respectively. All health providers and women provided informed consent to participate in the study.

2.1. Terminology used to describe skin color

This study measured skin color using the Brazilian Census Bureau definition. The question and responses are standardized and therefore commonly accepted in the country. We are aware that the terms that refer to skin color in Brazil, like "mixed" or "yellow", may be considered offensive in some parts of the world when directly translated from Brazilian Portuguese to English. As such terms may have different meanings depending on the language, culture and region, direct comparisons must be carried out carefully.

3. Results

The rapid training on preconception health, i.e., the intervention, increased the level of knowledge of preconception care among health providers but had no effect on its provision, as reported by reproductive-aged women attending the PHCFs. The exception was the increase in screening future pregnancy intention that was reported by the women.

Eighty-three health providers from the 8 PHCFs (40 doctors and 43 nurses) participated in the rapid training (no refusals: 40 doctors and 43 nurses): 23 health providers (8 doctors and 15 nurses) from the intervention group and 60 health providers (32 doctors and 28 nurses) from the control group (for whom rapid training was offered at the end of the study). The number of health providers from the intervention group who completed the instruments in all stages was 19 before the intervention and 16 after the intervention. The number of health providers in the control group who completed the instruments in all stages was 50 before the intervention and 35 after the intervention.

Most of the health providers were female (81.9 %), with a mean age of 37.5 years (dp = 8.7), more than five years of training (65.1 %) and experience working in a PHCF (61.5 %). Regarding their background, most reported a specialization course (73.5 %), and only 12.1 % had done a residency in public health and/or family health. The profile of the health providers in the intervention group was similar to that of those in the control group, except for the fact that in the intervention group, there was a higher percentage of health providers with specialization (p = 0.004), as shown in Table 1.

In the preintervention stage, no health providers got all the answers correct (maximum number of correct answers was 11), and no health professional got all the answers incorrect (minimum number of incorrect answers was 4). Statements with the highest proportion of correct answers included numbers 7, 1, 6 and 9. Statements with the highest proportion of incorrect answers included numbers 2, 4 and 10 (Table 2). In general, 70.4 % of the responses were correct in the preintervention period and 77.7 % were correct in the postintervention period.

In the preintervention stage, the mean scores of the knowledge of preconception care were similar between the intervention and control groups. There was an increase of 2 points in the mean of the intervention group, while the increase in the control group was 1.6 (p < 0.001), which is statistical evidence that the knowledge of the intervention group increased more than that of the control group (Table 3).

Our strategy to measure the effects of the training on the provision of preconception care was using face-to-face interviews with women attending PHCFs (n = 464: 231 in the intervention group and 233 in the control group – six refusals). The results show that women in the intervention group were 32.2 years old and those in the control group were 32.1 years old; the majority were living with a partner (76.2 % and 66.5 %, respectively) and had no private health insurance (80.5 % and 83.7 %, respectively). Less than half were currently working. The majority were of low socioeconomic status (71.5 %), and over half had completed high school. Most reported at least one pregnancy and a fifth reported at least one abortion. Sociodemographic and reproductive characteristics were similar when comparing women in the control and intervention groups, except that a higher proportion of women reported living with a partner in the intervention group (p = 0.021) (Table 4).

While there was a significant effect of the intervention on the health providers' knowledge of preconception care, our results show that the training did not increase or significantly change the provision of preconception health care. Few women reported receiving any preconception care at all (Table 5). However, women in the intervention group reported having been screened more often for future pregnancy intention than women in the control group after the intervention (p = 0.034). No other preconception measure was reported to be delivered more often after the intervention.

4. Discussion

Our study was conducted with the aim of assessing the effect of a rapid training intervention on the knowledge of health providers and the provision of preconception care in primary care health services. Our results showed that the training increased the level of knowledge of preconception care of health providers but had no effect on the provision of preconception care, with the exception of a slight increase in screening for the intention to become pregnant, which was supported by the reports of the women attending the

Table 1
Personal characteristics, training, and professional experience of health professionals according to intervention and control groups.

Variable	Intervention Group		Control Group		p
	Mean (sd)	Range	Mean (sd)	Range	
Age	38.9 (8.4)	27/60	37.0 (8.8)	24/66	0.237[a]
Variable	**N**	**%**	**n**	**%**	
Sex					0.172[b]
Female	2	8.7	13	21.7	
Male	21	91.3	47	78.3	
Background					0.132[b]
Nurse	15	65.2	28	46.7	
Doctor	8	34.8	32	53.3	
Work experience (years)					0.090[c]
<1	–	–	8	13.3	
2–5	5	21.7	19	31.7	
≥5	18	78.3	33	55.0	
Training after bachelor's degree					0.004[c]
None	–	–	11	30.0	
Specialization		95.6	39	65.0	
Master's degree		4.4	3	5.0	
Residency					0.055[c]
Yes	23	100.0	50	83.3	
No	–	–	10	16.7	
Total	**23**	**100**	**60**	**100**	

[a] Wilcoxon-Mann-Whitney.
[b] Pearson's Chi-square.
[c] Fisher's Exact.

Table 2
Percentage of health providers' correct answers for statements about preconception care.

Statements	Intervention group		Control group	
	Preintervention	Post-intervention	Preintervention	Post-intervention
1. Folic acid supplementation during the preconception period is recommended for neural tube prevention.	100.0	93.7	96.1	100.0
2. Women planning to become pregnant should start folic acid supplementation at least three weeks before conception.	26.3	31.2	3.9	22.9
3. A daily dose of 0.4 mg of folic acid before conception is recommended by the Ministry of Health.	50.0	93.7	74.5	77.1
4. For women at high risk of giving birth to a child with a neural tube defect, the recommended daily dose of folic acid is 0.10 mg before conception.	21.0	43.7	35.3	42.9
5. Women with a very low or very high BMI should be advised to reach their ideal BMI range before conception.	84.2	81.2	82.3	88.6
6. Carrying out preconception care contributes to the reduction of neonatal mortality.	94.7	100.0	94.1	97.1
7. Rubella infection in a pregnant woman can cause deafness in fetuses.	100.0	100.0	86.3	97.1
8. A woman under 30 years of age who is sexually active for six months does not become pregnant, even when not using contraceptives. This is condition of infertility.	89.5	81.2	92.2	77.1
9. Preconception care includes the reduction or cessation of tobacco before conception.	100.0	100.0	86.3	97.1
10. Depression in the period before conception can cause premature birth.	15.8	50.0	31.4	57.1
11. Half of the women planning to become pregnant use folic acid in the preconception period.	73.7	87.5	68.6	71.4
12. Preventing infection from the Zika virus is part of preconception care.	89.5	100.0	80.4	91.4
13. Encouraging long intervals between pregnancies is part of preconception care.	94.7	81.2	74.5	74.3

Table 3
Mean score of preconception care knowledge.

	Intervention	Control	
	Mean (sd)	Mean (sd)	p[a]
Preintervention	8.4 (1.1)	8.3 (1.6)	<0.001
Post-intervention	10.4 (1.2)	9.9 (1.3)	

[a] Mixed effect model.

PHCFs.

Health providers in both the intervention and control groups showed considerable knowledge of preconception care before the intervention. Comparing our results with others, it was observed that the knowledge of health providers in our study was even higher than that observed in either high-income countries or other middle-income countries [7,9,25–29].

Among all the statements used to measure the level of knowledge of preconception care, those with fewer correct answers were regarding the optimal preconception folic acid supplementation initiation timing and the folic acid dosage recommended for women with a history of gestation of a fetus with a neural tube disorder. Such a situation was also observed in a study developed in Serbia among pharmacists regarding the counseling of folic acid supplementation for women [30]. This result may be a consequence of discrepancies over the recommendations and guidelines from the MOH, WHO and other local, regional and international health boards [23,31,32]. For example, the São Paulo City Health Board recommends starting folic acid supplementation three months before conception, without mentioning the appropriate dosage [33], while the Brazilian MOH Antenatal Protocol recommends daily supplementation of 5 mg for women planning to become pregnant for 60–90 days before conception [34]. This situation demands studies and expert meetings in an effort to try to establish some standardization of such preconception care protocols at the national and international levels considering local specificities.

Nevertheless, the rapid training intervention increased the level of knowledge of the health providers similar to results observed in studies conducted in the USA with health care students and residents [13,15]. As insufficient training is reported to negatively impact the confidence and ability of a health care provider to provide preconception care [5,6,35,36], our result resonates with others that highlight the need for specific and continuous in-work trainings that may allow updates in preconception care-related topics to optimize its provision [29].

Our results showed that the increase in health care providers' knowledge of preconception care did not necessarily improve its provision. Studies conducted in South Africa and Ethiopia confirmed that high levels of knowledge and positive attitudes on preconception care are not related to its provision [37,38]. However, interventions aimed at improving clinical practice through the development of guidelines, the dissemination of these guidelines to health providers, and the dissemination of information on the benefits of preconception care to the general population showed positive effects on the provision of preconception care [16–18,39]. Such controversies confirm that there is still a gap in the field of reproductive health concerning how to improve the provision of preconception care. Undoubtedly, other initiatives may be needed to expand preconception care delivery. One initiative could be the

Table 4
Sociodemographic and reproductive characteristics of women attending PHCFs according to intervention or control groups.

Variable	Intervention Group		Control Group		
	Mean(sd)	Range	Mean(sd)	Range	p
Age	32.2 (8.8)	18–49	32.1(8.9)	18–49	0.878[a]
Age at menarche (years)	12.7 (1.8)	7–19	12.7(1.7)	7–19	0.884[b]
Age at first intercourse (years)	16.7 (2.8)	6–32	17.2(3.1)	11–31	0.068[a]
Age at first pregnancy (years)	20.8 (4.8)	13–36	21.1(4.9)	12–39	0.577[b]
Number of pregnancies	2.4 (1.4)	0–7	1.8(1.2)	0–7	0.206[b]
Variable	**n**	**%**	**n**	**%**	**p**
Skin color					0.823[c]
White	65	28.1	71	30.5	
Mixed	121	52.4	113	48.5	
Black	37	16.0	43	18.5	
Yellow	7	3.0	5	2.1	
Indigenous	1	0.4	1	0.4	
Lives with a partner					0.021[d]
No	55	23.8	78	33.5	
Yes	176	76.2	155	66.5	
Paid job					0.864[d]
No	135	58.4	138	59.2	
Yes	96	41.6	95	40.7	
Private health insurance					0.373[d]
No	186	80.5	195	83.7	
Yes	45	19.5	38	16.3	
Education					0.365[d]
Illiterate	33	14.3	30	12.8	
Elementary	50	21.6	47	20.2	
High school	136	58.9	134	57.5	
Tertiary	12	5.2	22	9.4	
Socioeconomic status					0.801[c]
High	29	12.5	32	13.7	
Middle	170	73.6	162	69.5	
Low	32	13.8	39	16.7	
Previous pregnancy					0.667[d]
No	22	9.5	25	10.7	
Yes	209	90.5	208	89.3	
Previous abortion					0.846[d]
No	169	79.0	165	78.2	
Yes	45	21.0	46	21.8	

[a] Two Sample.
[b] Wilcoxon-Mann-Whitney.
[c] Fisher's Exact.
[d] Pearson's Chi-square.

Table 5
Preconception care provisions reported by health providers and women pre- and postintervention according to intervention and control groups.

Variable	Intervention group				Control group				p[a]
	Preintervention		Pos-intervention		Preintervention		Post-intervention		
	n	%	n	%	n	%	n	%	
Health providers									
Routinely screens pregnancy intention	19	100.0	15	93.7	45	90.0	28	80.0	0.749
Disseminates information about preconception care	17	89.5	14	87.5	42	85.7	29	82.9	0.334
Provides information about preconception care after a rapid pregnancy test	17	89.5	14	93.3	44	86.3	33	94.3	0.324
Prescribes folic acid before conception	4	21.0	6	40.0	21	42.0	14	40.0	0.213
Reproductive-age women									
Screened for future pregnancy intention	22	19.0	25	21.7	26	22.0	12	10.4	0.034
Had ever heard of preconception care	23	19.8	17	14.8	14	11.9	8	7.0	0.705
Had ever been counseled about preconception care	11	9.5	9	7.8	6	5.1	3	2.6	0.606
Counseled about preconception care after a pregnancy test**	5	4.4	1	0.9	2	1.7	–	–	0.882
Took folic acid before conception in the last pregnancy**	7	6.0	5	4.4	3	2.5	4	3.5	0.511

[a] Penalized Likelihood Logistic Regression (Firth method).

reorganization of primary health services, such as providing time in the schedule of health professionals, the development of protocols and guidelines, the support of national and local governments in prioritizing health care before conception as part of maternal care, and investments in disseminating preconception care awareness among women, men and couples [37,38].

The only change observed in the provision of preconception care after the rapid training was pregnancy intention screening. Women attending the PHCFs whose health providers were trained in providing preconception care more frequently reported that they were asked about their future pregnancy intention than those who attended the PHCFs whose health providers were not trained. Hall et al. (2016) [40] proposed a theoretical framework that situates regular pregnancy intention screening in the center of a flow created to identify reproductive health needs. Once a woman or a couple reports the desire to become pregnant, they should be recommended to receive preconception care. When a woman or couple reports the need for spacing or limiting births, they should be recommended to receive family planning services. In both situations, the aim is to expand the opportunity for experiencing a planned pregnancy, which allows opportunities for timely preconception care [2]. In this way, previous research recommended that preconception health should be addressed in every visit to the health service [4]. Undoubtedly, pregnancy intention screening should be part of such an approach.

Nevertheless, these findings need to be interpreted with caution, since there was only a modest increase in the proportion of women reporting being screened for future pregnancy intention in the intervention group, whereas in the control group, this proportion actually decreased. Furthermore, a notable disparity was observed between the perspectives of health providers and women regarding pregnancy intention screening. Regardless of belonging to the control or the intervention group, the majority of health providers reported routine screening for future pregnancy, and this did not significantly change after the intervention. To gain a deeper understanding of pregnancy intention screening by health providers and its awareness among individuals of reproductive age, future research should thoroughly explore these differences.

From the perspective of the women attending the PHCFs, the results show that they have not been the target of preconception care, irrespective of whether they were in the intervention or control groups. Few had ever heard of or were informed about preconception care or had a folic acid prescription before conception, which is in line with other studies [41–44]. Likewise, a Brazilian study showed that few women of reproductive age adopted preconception measures, such as seeking medical assistance, starting to eat healthier, taking folic acid, stopping or reducing alcohol consumption and smoking, even if they had experienced a planned pregnancy [20]. Therefore, improvements in the provision of preconception care in the country would largely benefit childbearing women, since maternal mortality rates in Brazil have not decreased in recent years [45], confirming the need for the implementation of high-quality maternal health care.

This study has certain limitations that warrant attention. Firstly, we did not inquire about women's individual pregnancy intention, which prevents us from speculating whether our results would differ among those actively seeking pregnancy, and consequently, more responsive to topics that concern preconception care, or those aiming to space or limit childbirth. Moreover, we were unable to conduct interviews with the same group of women both before and after the intervention. However, by employing consistent sampling procedures for selecting women of reproductive age at PHCFs, we ensured that the interviewed women had similar demographic and reproductive characteristics. Despite these limitations, our study boasts several strengths as it encompasses the perspectives of both health providers and women on preconception care and includes a control group, enabling meaningful comparisons.

5. Conclusions

Although the knowledge of health providers on preconception care is a fundamental requirement for its provision in primary health care settings, rapid training focused on preconception health topics was not sufficient to change their practices, with the exception of pregnancy intention screening, which increased after the training. It seems that other elements, such as the reorganization of primary health care services to prioritize non-pregnant women, the development and implementation of specific guidelines, and the implementation of strategies to disseminate preconception care awareness among individuals of reproductive age may be also important for full preconception care implementation in addition to health providers' knowledge of such issues.

In particular, our findings underscore the importance of continuous service training around preconception care, as there is room for improvement in health providers' knowledge about the topic. Clinical guidelines that clearly define what preconception care entails, when it should be introduced, and how to incorporate it into clinical practice would also be beneficial for providers. Additionally, we highlight the significance of viewing any interaction with individuals of reproductive age as an opportunity to address preconception health issues, including weight loss, reduction in tobacco use, and increased physical activity, among others. Furthermore, it is crucial for providers to receive training that enables them to effectively and consistently probe pregnancy intention. To enhance clinical care, new measurement scales, like the Desire to Avoid Pregnancy [46], could be valuable tools to consider incorporating into routine clinical care.

Ethics statement

This study was reviewed and approved by the Sao Paulo City Health Board and the University of Sao Paulo School of Nursing Institutional Review Boards, with the approval numbers 3269514 and 3167031, respectively. All health providers and women provided informed consent to participate in the study.

Data availability statement

The data associated with our study has not been deposited into a publicly available repository due to their containing information

that could compromise the privacy of research participants, especially health providers, but will be made available on reasonable request to the corresponding author (ALVB).

The authors certify that they have no affiliations with, or involvement in, any organization or entity with any financial interest, or non-financial interest, in the subject matter of this article.

Ethical approval

Ethical approval was obtained from the School of Nursing | University of São Paulo of São Paulo, Brazil, CAEE: 03791218.7.3001.0089.17/April/2019.

Funding sources

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

Clinical trials registration

Registered at the Brazilian Registry of Clinical Trials (ReBEC - https://ensaiosclinicos.gov.br/) process number RBR-4qgwpq; Trial identification UTN code: U1111-1254-7700.

CRediT authorship contribution statement

Natália de Castro Nascimento: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ana Luiza Vilela Borges:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Elizabeth Fujimori:** Writing – review & editing, Writing – original draft. **Belarmina Reis-Muleva:** Writing – review & editing, Writing – original draft, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to thank all the women and health care professionals who participated in the study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e30090.

References

[1] World Health Organization - WHO, Meeting to Develop a Global Consensus on Preconception Care to Reduce Maternal and Childhood Mortality and Morbidity, WHO, Geneva, 2012.
[2] J. Stephenson, N. Heslehurst, J. Hall, D.A.J.M. Schoenaker, J. Hutchinson, J. Cade, et al., Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health, Lancet 391 (10132) (2018) 1830–1841.
[3] B. Hill, J. Hall, H. Skouteris, S. Currie, Defining preconception: exploring the concept of a preconception population, BMC Pregnancy Childbirth 20 (2020) 280.
[4] C.L. Robbins, L. Gavin, M.W. Carter, S.B. Moskosky, The link between reproductive life plan assessment and provision of preconception care at publicly funded health centers, Perspect. Sex. Reprod. Health 49 (3) (2017 Sep) 167–172.
[5] T. Heyes, S. Long, N. Mathers, Preconception care: practice and beliefs of primary care workers, Fam. Pract. 21 (1) (2004) 22–27.
[6] D. Mazza, A. Chapman, S. Michie, Barriers to the implementation of preconception care guidelines as perceived by general practitioners: a qualitative study, BMC Health Serv. Res. 13 (2013) 36.
[7] K. Guess, L. Malek, A. Anderson, M. Makrides, S.J. Zhou, Knowledge and practices regarding iodine supplementation: a national survey of healthcare providers, Women Birth 30 (1) (2017 Feb) e56–e60.
[8] A. Kassa, S. Human, H. Gemeda, Level of healthcare providers' preconception care (PCC) practice and factors associated with non-implementation of PCC in hawassa, Ethiopia, Ethiop J Health Sci. 29 (1) (2019) 903–912.
[9] I.S. Rodino, S.M. Byrne, K.A. Sanders, Eating disorders in the context of preconception care: fertility specialists' knowledge, attitudes, and clinical practices, Fertil. Steril. 107 (2) (2017 Feb) 494–501.
[10] S. Van Voorst, S. Plasschaert, L. de Jong-Potjer, E. Steegers, S. Denktaş, Current practice of preconception care by primary caregivers in The Netherlands, Eur. J. Contracept. Reprod. Health Care 21 (3) (2016) 251–258.
[11] A.S. Coll, J.E. Potter, N. Chakhtoura, M.L. Alcaide, R. Cook, D.L. Jones, Providers' perspectives on preconception counseling and safer conception for HIV-infected women, AIDS Care 28 (4) (2016) 513–518.

[12] H. Khekade, A. Potdukhe, A.B. Taksande, M.B. Wanjari, S. Yelne, Preconception care: a strategic intervention for the prevention of neonatal and birth disorders, Cureus 15 (6) (2023 29) e41141.
[13] C. Delgado, Pregnancy 101: a call for reproductive and prenatal health education in college, Matern. Child Health J. 17 (2) (2013 Feb) 240–247.
[14] K.W. Hauser, C.M. Lilly, J.L. Frías, Florida health care providers' knowledge of folic acid for the prevention of neural tube defects, South. Med. J. 97 (5) (2004) 437–439.
[15] C.L. Spagnoletti, A.M. Sanders, J.B. McGee, J.E. Bost, M.A. McNeil, Teaching internal medicine residents to care for reproductive-age and pregnant women: an effective Web-based curriculum, Teach. Learn. Med. 20 (2) (2008) 186–192.
[16] V. Egen, J. Hasford, Prevention of neural tube defects: effect of an intervention aimed at implementing the official recommendations, Sozial- Präventivmed. 48 (1) (2003) 24–32.
[17] A.S. Cullum, Changing Provider practices to enhance preconceptional wellness, Clinical Issues 32 (4) (2003) 543–549.
[18] E. Kvach, H. Marcus, L. Loomis, Evaluation of resident and faculty performance in routinely addressing unmet reproductive health needs in a teaching health center, Fam. Med. 50 (4) (2018) 291–295.
[19] M. do C. Leal, C.L. Szwarcwald, P.V.B. Almeida, E.M.L. Aquino, M.L. Barreto, F. Barros, et al., Saúde reprodutiva, materna, neonatal e infantil nos 30 anos do Sistema Único de Saúde (SUS), Ciência Saúde Coletiva 23 (6) (2018) 1915–1928.
[20] A.L.V. Borges, O.A. Santos, N.C. Nascimento, C.B. Chofakian, F.A. Gomes-Sponholz, Preconception health behaviors associated with pregnancy planning status among Brazilian women, Rev. Esc. Enferm. USP 50 (2) (2016) 208–216.
[21] X. Wei, Z. Zhang, J.D. Walley, J.P. Hicks, J. Zeng, S. Deng, et al., Effect of a training and educational intervention for physicians and caregivers on antibiotic prescribing for upper respiratory tract infections in children at primary care facilities in rural China: a cluster-randomised controlled trial, Lancet Global Health 5 (12) (2017) e1258–e1267.
[22] Organisation for Economic Co-operation and Development (OECD), Primary Health Care in Brazil, OECD Reviews of Health Systems, OECD Publishing, Paris, 2021, https://doi.org/10.1787/120e170e-en.
[23] Brasil. Ministério da Saúde. Instituto Sírio-Libanês de Ensino e Pesquisa, Protocolos da Atenção Básica: Saúde das Mulheres, 1a ed, Brasiliana: Ministério da Saúde (2016). 231p.
[24] R.M. Geraldo, J.C. Oliveira, L.S.C. Alexandre, M.R.A. Aguiar, A.F.S. Vieira, A.C.C.G. Germani, Preenchimento do quesito raça/cor na identificação dos pacientes: aspectos da implementação em um hospital universitário, Ciência Saúde Coletiva 27 (10) (2022) 3871–3880.
[25] T. Abu-Hammad, J. Dreiher, D.A. Vardy, A.D. Cohen, Physicians' knowledge and attitudes regarding periconceptional folic acid supplementation: a survey in Southern Israel, Med. Sci. Mon. Int. Med. J. Exp. Clin. Res. 14 (5) (2008) 262–267.
[26] A. Aggarwal, G.D. Kumhar, D. Harit, M.M. Faridi, Role of folic acid supplementation in prevention of neural tube defects: physicians yet unaware, J Prev Med Hyg 51 (3) (2010) 131–132.
[27] A. Kassa, S.P. Human, H. Gemeda, Knowledge of preconception care among healthcare providers working in public health institutions in Hawassa, Ethiopia, PLoS One 13 (10) (2018) e0204415.
[28] A. Miranda, R.R. Dávila Torres, J.J. Gorrín Peralta, I.M. Longo, Puerto Rican primary physicians' knowledge about folic acid supplementation for the prevention of neural tube defects, Birth Defects Res A Clin Mol Teratol 67 (12) (2003) 971–973.
[29] A.S. Sori, K.T. Roba, T.A. Yadeta, H.D. Jiru, K.N. Metebo, H.A. Weldekidan, L.D. Regassa, Knowledge of preconception care and associated factors among maternal health care providers working in urban public health institutions of Eastern Ethiopia, Women's Health 17 (2021) 1–11.
[30] M. Zeković, D. Krajnović, M. Nikolić, T. Stojković, M. Gurinović, M. Glibetić, Periconceptional folic acid supplementation: knowledge, attitudes and counselling practice of Serbian pharmacists and pharmacy technicians, Vojnosanit. Pregl. 76 (10) (2019) 1127–1138.
[31] Centers for Disease Control and Prevention - CDC, Before Pregnancy, 2020. Available from: https://www.cdc.gov/preconception/index.html.
[32] WHO, Periconceptional Folic Acid Supplementation to Prevent Neural Tube Defects [Internet], 2019. Geneve; 2019, https://www.who.int/elena/titles/folate_periconceptional/en/.
[33] São Paulo (Município), Secretaria da Saúde, in: Manual técnico: saúde da mulher nas Unidades Básicas de Saúde, vol. 2, SMS, São Paulo, 2012.
[34] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica, Atenção ao pré-natal de baixo risco, 1a ed. Brasiliana: Ministério da Saúde (2012). 320p.
[35] J. Goossens, M. De Roose, A. Van Hecke, R. Goemaes, S. Verhaeghe, D. Beeckman, Barriers and facilitators to the provision of preconception care by healthcare providers: a systematic review, Int. J. Nurs. Stud. 87 (2018) 113–130.
[36] A. Steel, J. Lucke, R. Reid, J. Adams, A systematic review of women's and health professional's attitudes and experience of preconception care service delivery, Fam. Pract. 33 (6) (2016) 588–595.
[37] W.A. Seman, S. Teklu, K. Tesfaye, Assessment of the knowledge, attitude and practice of residents at tikur anbesa hospital about preconceptional care 2018, Ethiopian Journal of Reproductive Health 11 (1) (2019) 19–28.
[38] W.C. Ukoha, M. Dube, Primary health care nursing students' knowledge of and attitude towards the provision of preconception care in KwaZulu-Natal, Afr J Prim Health Care Fam Med 11 (1) (2019 Nov) 1916.
[39] E. Kvach, J. Lose, H. Marcus, L. Loomis, Routine screening for pregnancy intention to address unmet reproductive health needs in two urban federally qualified health centers, J. Health Care Poor Underserved 28 (4) (2017) 1477–1486.
[40] J.A. Hall, S. Mann, G. Lewis, J. Stephenson, C. Morroni, Conceptual framework for integrating 'pregnancy planning and prevention' (P3), J. Fam. Plann. Reprod. Health Care 42 (1) (2016) 75–76.
[41] M.G. Backhausen, M. Ekstrand, T. Tydén, B.K. Magnussen, J. Shawe, J. Stern, et al., Pregnancy planning and lifestyle prior to conception and during early pregnancy among Danish women, Eur. J. Contracept. Reprod. Health Care 19 (1) (2014) 57–65.
[42] D. Luton, A. Forestier, S. Courau, P.F. Ceccaldi, Preconception care in France, Int. J. Gynaecol. Obstet. 125 (2) (2014) 144–145.
[43] K.D. Rosenberg, J.M. Gelow, A.P. Sandoval, Pregnancy intendedness and the use of periconceptional folic acid, Pediatrics 111 (5 Pt 2) (2003) 1142–1145.
[44] J. Stephenson, D. Patel, G. Barrett, B. Howden, A. Copas, O. Ojukwu, et al., How do women prepare for pregnancy? Preconception experiences of women attending antenatal services and views of health professionals, PLoS One 9 (7) (2014) e103085.
[45] Brasil. Ministério da Saúde. Saúde Brasil 2017:uma análise da situação de saúde e os desafios para o alcance dos objetivos de desenvolvimento sustentável. Brasília, Ministério da Saúde; 2018. 430p.
[46] C.H. Rocca, L.J. Ralph, M. Wilson, H. Gould, D.G. Foster, Psychometric evaluation of an instrument to measure prospective pregnancy preferences: the desire to avoid pregnancy scale, Med. Care 57 (2) (2019) 152–158.