

# Assessment of content, behavior change techniques, and quality of unintended pregnancy apps in Spain: Systematic search on app stores

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## Abstract

**Objective:** Unintended pregnancies are a public health problem that represents 48% of global pregnancies. Despite the proliferation of smartphones there is limited data on the app's features on unintended pregnancy. The purpose of this research was to identify free apps available in Spanish, in the iOS Store and Google Play, which can be recommended to prevent unintended pregnancies in adolescents.

**Methods:** A systematic search to identify apps was performed in the iOS App Store and in Google Play aiming to replicate the way a patient might access an “unintended pregnancy prevention” app. Additionally, the quality, using the Mobile Application Rating Scale, and content were assessed.

**Results:** A total of 4614 apps were identified, of which 8 were retrieved for assessment (0.17%). The mean for objective and subject quality was 3.39 (standard deviation (SD) = 0.694) and 1.84 (SD = 0.626), respectively. A total of 16 thematic categories were identified. The mean of topics covered in the apps was 5.38 (SD = 2.925) being those related to contraception the more frequent.

**Conclusion:** The results of the present study suggest that only a small percentage of free pregnancy prevention apps in Spanish should be recommended. The contents of the apps retrieved meet the potential necessities of adolescents.

## Keywords

Adolescent, pregnancy, unwanted, cell phone, mHealth, health promotion

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## Introduction

Unintended pregnancies (UPs) are a public health problem that, despite showing a downward trend, are a priority that needs to be addressed as these pregnancies represent 48% of global pregnancies.<sup>1</sup> According to Starrs et al.<sup>2</sup> sexual and reproductive health are essential for sustainable development due to its relation to gender equality and women's well-being and its impact on the mothers' and children's health.

UPs can be considered especially serious during adolescence as they lead to grave complications for both the pregnant woman and the child. The literature shows a greater risk of preeclampsia, postpartum endometriosis and systemic infections,<sup>3</sup> preterm births, greater neonatal mortality, and postpartum depression.<sup>4</sup>

According to Fleming et al.<sup>5</sup> adolescents are at a greater risk of UPs than populations of other ages due to several factors. On the one hand, their age,<sup>6</sup> and on the other hand, some behaviors that predict this risk and need to be

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paid special attention to such as alcohol and substance consumption,<sup>5</sup> low perceived risk of pregnancy<sup>7</sup> and lack of knowledge regarding contraception and the use of contraceptives and their benefits and risks,<sup>8</sup> for example.

There is evidence about the effectiveness of interventions aimed at reducing the risk of UPs. They are diverse when it comes to design and content.<sup>8–11</sup> Among these interventions, those that incorporate digital technology stand out. Adolescents belong to a generation that uses technology such as mobile phone applications (apps) frequently. The use of apps as tools to promote healthy behaviors among this population is frequent.<sup>12</sup> In fact, interventions specifically targeting sexual behaviors using mobile technology have already been developed.<sup>13</sup>

There are several factors in favor of integrating apps as tools for UPs prevention. The percentage of adolescents who use mobile phones has increased notably. In Spain, almost 100% of adolescents are frequent users of these devices.<sup>14</sup> The attitude of adolescents toward this integration is generally very positive and they highlight the empowerment derived from these tools.<sup>12,15</sup> There are sexual health apps specifically designed for adolescents that have proved viable for its use among this population.<sup>16–18</sup>

While it seems that there are already apps that can be used to share resources and knowledge for pregnancy prevention among adolescents, considering the sheer number of apps available in digital stores, it seems convenient to establish criteria to determine which apps can be recommended and which cannot. This has been previously done. For example, Chen et al.<sup>19</sup> developed an evaluation framework specifically designed for apps for adolescent pregnancy prevention based on four domains: (1) app characteristics, (2) user interface features, (3) adolescent pregnancy prevention best practices, and (4) general sexual and reproductive health features.

As no other study specifically assessing these aspects in apps for UP prevention in Spain has been found, the present study was developed with the purpose of identifying which free apps available in Spanish, in the iOS Store and Google Play, can be recommended for UP prevention among adolescents.

## Methods

### Design

This is a systematic, step-by-step review that included two steps: (1) Identification and selection of apps with the purpose of ‘preventing UPs in adolescents’ available in the iOS Store and Google Play between November and December 2020; (2) Assessment of quality and content. No humans were involved in the analysis so consent statement was not necessary.

### Intervention

The methodology to identify free apps available in Spanish, in the iOS Store and Google Play, that can be recommended

to prevent UPs in adolescents include two steps: (i) selection of Smartphone Apps and (ii) quality and content assessment of selected apps.

**Step 1: Selection of smartphone apps.** Our methods sought to replicate the way a patient might access an “unintended pregnancy prevention” app. Searches were performed in the iOS App and Google Play Stores using the following Spanish keywords in both stores: “*embarazo*” (pregnancy), “*prevención del embarazo*” (pregnancy prevention), “*prevenir el embarazo*” (prevent pregnancy), “*embarazo no deseado*” (unintended pregnancy), “*adolescente y embarazo*” or “*adolescencia y embarazo*” (adolescent and pregnancy), “*contracepción*” (contraception), “*contraceptivo*” or “*anticonceptivo*” (contraceptive), “*comunicación sexual*” (sexual communication), “*educación sexual*” (sexual education) and “*salud reproductiva*” (reproductive health). The searches were performed using an iPad Air (4th Generation) and a Samsung Galaxy Tab A6.

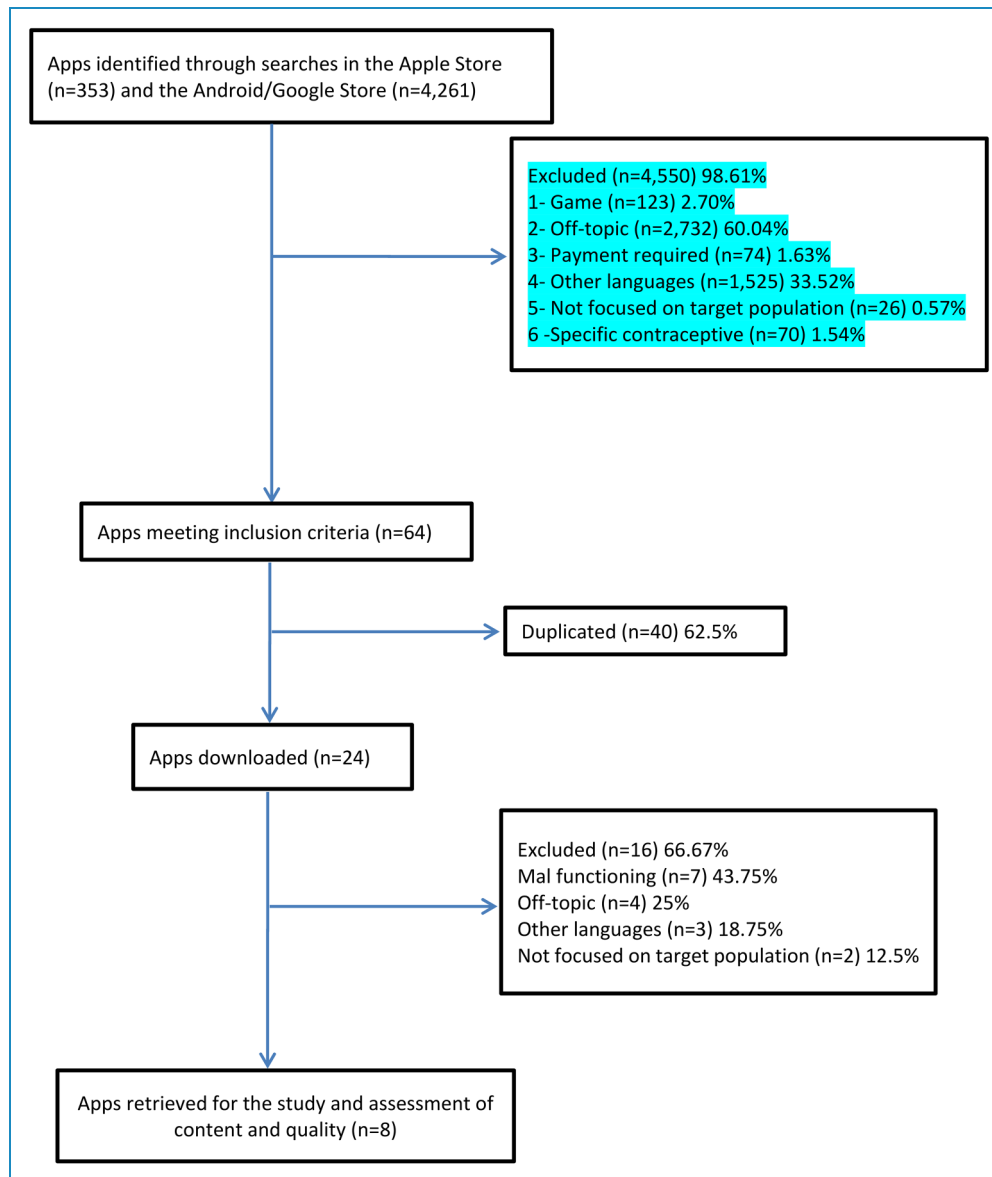
An initial review of the apps, developed by two researchers, based on the description available in digital stores was performed. The apps meeting the following criteria were selected (i) content related to pregnancy prevention; (ii) free; and (iii) available in Spanish. And the exclusion criteria were (i) the app was classified as a game/entertainment and therefore had no healthcare aim; (ii) it did not target the population under study (adolescents); (iii) the aim was exclusively pregnancy monitoring and/or delivery; and (iv) were related to specific contraceptives or were alarms/reminders for contraception intake.

Duplicated apps were eliminated when they appeared as a consequence of searches with different keywords and/or in both stores.

The apps meeting the criteria previously established were downloaded and a second review was carried out based on usage. The same inclusion and exclusion criteria were used for the final selection, with malfunctioning or defective functioning added as exclusion criteria. The retrieved apps were considered apt to be recommended and quality and content were assessed.

### Step 2: Assessment of smartphone apps (quality and content).

**Quality assessment:** two reviewers assessed the apps’ quality for pregnancy tracking using the Spanish version of the Mobile Application Rating Scale (MARS) (internal consistency  $\alpha > 0.77$ ).<sup>20</sup> This version includes 23 items. And 19 items assess objective quality, which at the same time has 4 dimensions (engagement, functionality, esthetics, and information quality) and subjective quality (4 items). There are six additional items specific for health apps (awareness, improved knowledge and behaviors, change intention, social support, and behavior change). All items are rated on a 5-point scale (1, inadequate; 2, poor; 3, acceptable; 4, good; 5, excellent) with possible total scores being 1 to 5 for objective, subjective, and specific items. Mean scores were calculated for each domain and overall app quality was calculated by averaging the aggregated mean for all domains.



**Figure 1.** Flowchart of app search process.

Content assessment: a content analysis strategy was developed with the aim of reviewing which topics each app covered. A researcher identified all the topics related to the target of our study and synthesized information in categories.

No major differences were observed between both researchers. So, the results of all process were accorded by consensus.

### Data analysis

Total scores mean and standard deviation (SD) for each app on each domain of the MARS and the topics included were calculated. All statistical analyses were conducted using IBM SPSS version 27.0 with significance levels set at  $p < 0.05$ .

### Results

A total of 4614 apps were identified, 98.6% of which were eliminated ( $n = 4550$ ). After discarding duplicated apps, 24 apps were downloaded, of which 66.7% ( $n = 16$ ) were eliminated, with a final number of 8 apps retrieved for the assessment of quality and content (Figure 1).

### Quality assessment

The mean for objective quality was 3.39 (SD = 0.694), and for subjective quality was 1.84 (SD = 0.626) (Table 1). The scoring for independent items (specific part) was above 2.25 points (Table 1). All 75% of the apps had a scoring above 3.30 for objective quality while 50% had a scoring above 2 for subjective quality (Table 2).

### Content assessment

A total of 16 thematic categories were identified (Annex 1) with a mean of 5.38 (SD = 2.925). The most frequent topics covered in the apps were “types of contraceptive methods,” “description of contraceptive methods,” “mode of use of

contraceptive methods,” and “effectiveness of contraceptive methods.” The lowest number of categories covered in the app was 2 and the higher was 10 (Table 3).

**Table 1.** Mean (SD) MARS score.

Objective quality	3.39 (0.694)
Engagement	2.94 (0.725)
Functionality	4.22 (0.619)
Esthetics	3.58 (1.165)
Information	3.29 (0.788)
Subjective quality	1.84 (0.626)
Awareness	2.38 (0.916)
Knowledge	2.50 (1.069)
Behavior	2.25 (1.035)
Change intention	2.25 (1.035)
Social support	2.63 (0.916)
Behavior change	2.38 (1.060)

MARS: Mobile Application Rating Scale; SD, standard deviation.

### Discussion

While many hundreds of apps for the prevention of UPs are commercially available, of those retrieved in this study, only eight contained potentially suitable content to be recommended to adolescents. According to the criteria established by researchers approximately 0.17% of the apps assessed could be recommended. This percentage is lower than what was observed in previous similar studies, probably due to the application of more restrictive exclusion criteria.<sup>21</sup>

The existence of apps specifically designed to prevent UPs that can be recommended to adolescents can be very positively evaluated by healthcare professionals as these apps provide them with a set of tools that can complement their activity with benefits not present in in-person consultations. This contributes to the acquisition of knowledge and abilities related to a topic generally considered taboo and therefore adolescents will not fear being stigmatized for attending a sexual education consultation, and, finally, a great number of people can be reached at a low cost.<sup>15</sup> These aspects are of the utmost importance because there is a documented risk of low participation in programs for the prevention of UPs<sup>22</sup> and an inadequate adolescents' sexual knowledge.<sup>23</sup>

The results of previous interventions in which apps had been specifically used with the aim of modifying behaviors related to UPs demonstrate the effectiveness of apps to

**Table 2.** Mean (SD) objective and subjective quality score for each app.

App	Objective quality	Engagement	Functionality	Esthetics	Information	Subjective quality
(App)lícate con tu sexualidad	3.35	3.00	4.75	3.33	2.60	1.25
Métodos Anticonceptivos	2.06	1.40	3.75	1.33	1.75	1.00
CrESI	3.78	3.40	4.50	4.00	3.50	1.50
Mi Método	4.33	3.40	4.75	5.00	4.33	3.00
Olimpia: Educación Sexual	3.94	3.00	5.00	4.67	3.60	1.75
VAMOS. Servicios de salud sexual y reproductiva	3.29	2.00	4.00	3.67	3.80	2.00
Yo decido	3.47	3.00	3.75	4.00	3.40	2.25
Tú Decides: Prevención del Embarazo Adolescente e ITS	2.89	2.20	3.25	2.67	2.89	2.00

SD, standard deviation.

**Table 3.** Number of topics included in each app.

App	Number of topics included in the app
(App)lícate con tu sexualidad	3
Métodos Anticonceptivos	4
CrESI	10
Mi Método	8
Olimpia: Educación Sexual	3
VAMOS. Servicios de salud sexual y reproductiva	2
Yo decido	8
Tú Decides: Prevención del Embarazo Adolescente e ITS	5

increased intentions to use contraception, improved knowledge about sexual health,<sup>16</sup> or contraceptive knowledge.<sup>18</sup>

Even though references are lacking for quality comparison, as no other study using MARS for the assessment of apps specifically designed for adolescents in relation to UPs could be found, it can be stated that the scoring for quality can be considered acceptable. The study carried out by Yang et al.<sup>24</sup> is of reference. They assessed the quality of apps for men who have sex with men, and even though it is not completely comparable, it shares a theme and a target population with the present study. As observed in the present study, most of the apps obtained an objective quality scoring above 3, and it was higher than the scoring for subjective quality. Probably the lowest scoring for subjective quality can be related to the low scoring observed in the items related to payment. This can be justified by the context. On the one hand, the apps retrieved were free, which implies no payment will be required and it can bias the reviewer. On the other hand, among the characteristics of the Spanish health system we must highlight that it is free, which can lead to the reviewers' perception that it is not right to pay for the use of health apps, as this would contribute to reduced equity in access to health resources, a potential problem for adolescents.

The second criterion for the selection of the apps was content. This is an essential criterion as the need to obtain answers about sex during adolescence is greater than in older age groups<sup>8</sup> and therefore adolescents need to access reliable information. It is also important that the information has a holistic approach<sup>25</sup> and it is focused on the necessities and the reproductive objectives of adolescents.<sup>26</sup> In relation to content, a total of 17 different categories have been identified, those being related to contraceptive

methods the most frequently found in the apps. This result coincides with the study developed by Steinberg et al.<sup>17</sup> in which a specific app was used to prevent pregnancy and in which contraceptive methods were among the most frequently consulted topics. It is very positive for apps to cover this topic because adolescents face a challenge when selecting the most appropriate types of contraceptive methods for them or when engaging in safe sexual relations.<sup>27</sup> At the same time, inadequate use of<sup>28</sup> and the lack of knowledge about contraceptives<sup>29</sup> are directly related to UPs. It must also be highlighted that the appropriate use of contraceptives is one of the most effective methods to prevent undesired pregnancies.<sup>30,31</sup>

Another of the topics covered in the apps was the consequences derived from adolescent pregnancies. The perceived severity of a health problem is described in the Health Belief Model was one of the elements that motivates people to engage in healthy behaviors.<sup>32</sup> There are several risks, both for the woman and the child, related to adolescent pregnancies<sup>33</sup> and it is convenient for adolescents to learn about them to raise awareness about the situations they could potentially face.

Knowledge is essential so that female adolescents can have a clear vision of their risk of pregnancy, especially when pregnancies are unintended and undesired. Learning about real facts allows them to realize their susceptibility<sup>32</sup> in this case, of getting pregnant. It has been observed that a low susceptibility of getting pregnant has been associated with a higher risk of unwanted pregnancies.<sup>7,34</sup> On the other hand, perceived susceptibility also has a direct impact on some of the behaviors to develop to prevent pregnancy, such as the use of contraception.<sup>7,35</sup>

Another aspect described in the literature as effective is to combine multiple interventions aligned with the preferences of adolescents to specifically meet their potential needs related to sexual health and UPs.<sup>8</sup> Apps could contribute to complementing the care usually provided by sexual health services offering some advantages that in-person consultations do not, which, according to the bibliography, would contribute to increased effectiveness, but also to solving some difficulties inherent to traditional in-person consultations: fear of feeling observed and/or judged by others,<sup>8</sup> lack of confidence,<sup>36</sup> and the existence of barriers to the access health services.<sup>31</sup> Fear of feeling observed and/or judged by others, lack of confidence, and the existence of barriers to the access health services can prevent adolescents from obtaining the answers to their needs and this is a risk for pregnancy.<sup>8</sup>

Finally, being able to recommend reliable sexual health apps could contribute to helping adolescents who, due to their personal or sociodemographic characteristics, are at a higher risk of engaging in risk sexual behaviors and therefore are at a higher risk of UPs.<sup>25,37,38</sup>

Some limitations of this study should be noted. Our search was restricted to free apps. This was deliberate

because we did not want to include those that would incur a cost to people. Another possible limitation is related to the search strategy used. The lack of standardized search terms for apps has led to the use of those considered more adequate/fitting by the researchers based on their experience.

The present study proves that there are pregnancy prevention apps available in Spanish safe for recommendation by healthcare professionals. Additionally provides guidance to policy makers on the shortage of scientifically supported apps that are scientifically supported to prevent UPs and will inform decisions about the evaluation and regulation of such apps. Finally, this research could help guide future research efforts in the development and evaluation of apps to prevent UPs and will enable their use, based on scientific criteria, in research aimed at preventing UP in adolescents.

## Conclusion

The results of the present study highlight the existence of a small percentage of free apps available in Spanish specifically related to pregnancy prevention in adolescents that can be recommended. The contents of the apps retrieved meet the potential needs of adolescents, but there is still room for improvement when it comes to quality.

**Contributorship:** RMP and MFA were responsible for the study design and conceptualization, initial app review, data analyses and wrote the first draft of the manuscript and oversaw conduction of the study. XGM and SCS were involved in app quality assessment and manuscript preparation; AMM in app content assessment writing the manuscript. CPC contributed to the data analysis and manuscript preparation. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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## References

1. Bearak J, Popinchalk A, Ganatra B, et al. Unintended pregnancy and abortion by income, region, and the legal status of abortion: estimates from a comprehensive model for 1990–2019. *Lancet Glob Health* 2020; 8: e1152–e1161.
2. Stars AM, Ezeh AC, Barker G, et al. Accelerate progress—sexual and reproductive health and rights for all: report of the Guttmacher-Lancet Commission. *Lancet* 2018; 391: 2642–2692.
3. Ganchimeg T, Ota E, Morisaki N, et al. Pregnancy and child-birth outcomes among adolescent mothers: a World Health Organization multicountry study. *BJOG* 2014; 121: 40–48.
4. Çift T, Korkmaz E, Temur M, et al. Adolescent pregnancies: complications, birth outcomes and the possible solutions. *Ginekol Pol* 2017; 88: 393–397.
5. Fleming N, ÓDriscoll T, Becker G, et al. Adolescent pregnancy guidelines. *J Obstet Gynaecol Can* 2015; 37: 740–756.
6. Shu C, Fu A, Lu J, et al. Association between age at first sexual intercourse and knowledge, attitudes and practices regarding reproductive health and unplanned pregnancy: a cross-sectional study. *Public Health* 2016; 135: 104–113.
7. Britton LE, Judge-Golden CP, Wolgemuth TE, et al. Associations between perceived susceptibility to pregnancy and contraceptive use in a national sample of women veterans. *Perspect Sex Reprod Health* 2019; 51: 211–218.
8. Bitzer J, Abalos V, Apter D, et al. Targeting factors for change: contraceptive counselling and care of female adolescents. *Eur J Contracept Reprod Health Care* 2016; 21: 417–430.
9. De Vasconcelos S, Toskin I, Cooper B, et al. Behaviour change techniques in brief interventions to prevent HIV, STI and unintended pregnancies: a systematic review. *PLoS One* 2018; 13: e0204088.
10. Sanz-Martos S, López-Medina IM, Álvarez-García C, et al. Effectiveness of educational interventions for the prevention of pregnancy in adolescents. *Aten Primaria* 2019; 51: 424–434.
11. Pakarinen M, Kylmä J, Helminen M, et al. Vocational school students' self-evaluations of a sexual health promotion intervention. *Scand J Caring Sci* 2019; 33: 857–867.
12. Dute DJ, Bemelmans WJ and Breda J. Using mobile apps to promote a healthy lifestyle among adolescents and students: a review of the theoretical basis and lessons learned. *JMIR Mhealth Uhealth* 2016; 4: e39.
13. Berendes S, Gubijev A, McCarthy OL, et al. Sexual health interventions delivered to participants by mobile technology: a systematic review and meta-analysis of randomised controlled trials. *Sex Transm Infect* 2021; 97: 190–200.
14. Instituto Nacional de Estadística. *Proporción de personas que poseen un teléfono móvil, desglosada por sexo*. Madrid:INE, <https://www.ine.es/dynt3/inebase/index.htm?padre=4999&capsel=4999> (2019, accessed 17 February 2021).
15. Steinke J, Root-Bowman M, Estabrook S, et al. Meeting the needs of sexual and gender minority youth: formative research on potential digital health interventions. *J Adolesc Health* 2017; 60: 541–548.
16. Mesheriakova VV and Tebb KP. Effect of an iPad-based intervention to improve sexual health knowledge and intentions for contraceptive use among adolescent females at school-based health centers. *Clin Pediatr (Phila)* 2017; 56: 1227–1234.
17. Steinberg A, Griffin-Tomas M, Abu-Odeh D, et al. Evaluation of a mobile phone app for providing adolescents with sexual

- and reproductive health information, New York City, 2013-2016. *Public Health Rep* 2018; 133: 234–239.
18. Hebert LE, Hill BJ, Quinn M, et al. Mobile contraceptive application use in a clinical setting in addition to standard contraceptive counseling: a randomized controlled trial. *Contraception* 2018; 98: 281–287.
  19. Chen E and Mangone ER. A systematic review of apps using mobile criteria for adolescent pregnancy prevention (mCAPP). *JMIR Mhealth Uhealth* 2016; 4: e122.
  20. Martín Payo R, Fernández Álvarez MM, Blanco Díaz M, et al. Spanish adaptation and validation of the Mobile Application Rating Scale questionnaire. *Int J Med Inform* 2019; 129: 95–99.
  21. Perry R, Lunde B and Chen KT. An evaluation of contraception mobile applications for providers of family planning services. *Contraception* 2016; 93: 539–544.
  22. Salas-Wright CP, AbiNader MA, Vaughn MG, et al. Trends in participation in teen pregnancy and STI prevention programming, 2002-2016. *Prev Med* 2019; 126: 105753.
  23. Khalaf I, Abu Moghli F and Froelicher ES. Youth-friendly reproductive health services in Jordan from the perspective of the youth: a descriptive qualitative study. *Scand J Caring Sci* 2010; 24: 321–331.
  24. Yang G, Long J, Luo D, et al. The characteristics and quality of mobile phone apps targeted at men who have sex with men in China: a window of opportunity for health information dissemination? *JMIR Mhealth Uhealth* 2019; 7: e12573.
  25. Yoost JL, Hertweck SP and Barnett SN. The effect of an educational approach to pregnancy prevention among high-risk early and late adolescents. *J Adolesc Health* 2014; 55: 222–227.
  26. Upadhyay UD, Raifman S and Raine-Bennett T. Effects of relationship context on contraceptive use among young women. *Contraception* 2016; 94: 68–73.
  27. Tebb KP, Rodríguez F, Pollack LM, et al. Assessing the effectiveness of a patient-centred computer-based clinic intervention, Health-E You/Salud iTu, to reduce health disparities in unintended pregnancies among Hispanic adolescents: study protocol for a cluster randomised control trial. *BMJ Open* 2018; 8: e018201.
  28. Temple-Smith M and Sanci L. LARCs as first-line contraception—what can general practitioners advise young women? *Aust Fam Physician* 2017; 46: 710–715.
  29. Marcell AV, Gibbs SE, Choiriyyah I, et al. National needs of family planning among US men aged 15 to 44 years. *Am J Public Health* 2016; 106: 733–739.
  30. Grubb LK and Committee on Adolescence. Barrier protection use by adolescents during sexual activity. *Pediatrics* 2020; 146: e2020007245.
  31. Oringanje C, Meremikwu MM, Eko H, et al. Interventions for preventing unintended pregnancies among adolescents. *Cochrane Database Syst Rev* 2016; 2016: CD005215.
  32. Hall KS. The health belief model can guide modern contraceptive behavior research and practice. *J Midwifery Womens Health* 2012; 57: 74–81.
  33. Bellizzi S, Pichierri G, Menchini L, et al. The impact of under-use of modern methods of contraception among adolescents with unintended pregnancies in 12 low- and middle-income countries. *J Glob Health* 2019; 9: 020429.
  34. Londeree J, Nguyen N, Nguyen LH, et al. Underestimation of pregnancy risk among women in Vietnam. *BMC Womens Health* 2020; 20: 159.
  35. Gemmill A. Perceived subfecundity and contraceptive use among young adult U.S. women. *Perspect Sex Reprod Health* 2018; 50: 119–127.
  36. Bayer R, Santelli J and Klitzman R. New challenges for electronic health records: confidentiality and access to sensitive health information about parents and adolescents. *JAMA* 2015; 313: 29–30.
  37. Sámano R, Martínez-Rojano H, Chico-Barba G, et al. Sociodemographic factors associated with the knowledge and use of birth control methods in adolescents before and after pregnancy. *Int J Environ Res Public Health* 2019; 16: 1022.
  38. Metcalfe A, Talavlikar R, du Prey B, et al. Exploring the relationship between socioeconomic factors, method of contraception and unintended pregnancy. *Reprod Health* 2016; 13: 28.
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