



## Review article

## The Role of Community Health Workers in Preventing Adolescent Repeat Pregnancies and Births



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## A B S T R A C T

Intervention by community health workers (CHWs) is believed to prevent repeated childbearing among teenagers. This review investigated the effectiveness of CHWs in reducing repeated pregnancies and births among adolescents aged <20 years, 2 years after the delivery of their first child. Through electronic database and hand searching, experimental and/or observational studies were screened with their results undergoing systematic review and meta-analyses. Subgroup analyses were performed to further assess how study characteristics affected the pooled estimates and heterogeneity. A total of 11 eligible articles, from January 1980 to May 2015, were included. Seven studies evaluated repeated births and eight measured repeated pregnancies. Studies showed relevant disparities in terms of selected methodological aspects and program characteristics. Although most studies ( $n = 9$ ) were either of “strong” or of “moderate” quality, only two of five finding a significant reduction exhibited a high level of quality as the other three failed to adjust results for confounders. Random effects modeling revealed an overall 30% decrease in repeated adolescent births (odds ratio = .70, confidence interval = .49–.99) among CHW-visited areas relative to nonvisited sites. On the other hand, no significant association was detected in terms of repeated pregnancies (odds ratio = .96, confidence interval = .70–1.28).

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IMPLICATIONS AND  
CONTRIBUTION

This systematic review reveals a consensus among recent study findings that community health worker visitation is an effective strategy for the prevention of repeated adolescent births. However, limited available research, particularly in developing nations, suggests the need for more program evaluations assessing efficacy of community health workers, in addition to operational and sustainability issues.

Repeated teenage pregnancy continues to undermine the overall well-being of women and children globally, despite the implementation of innovative prevention strategies. Recent estimates show that 25% of adolescents who have already given

birth tend to deliver again within 2 years postpartum [1,2]. The Centres for Disease Control and Prevention reported that one in every five teen births in the United States was a repeated birth (RB) in 2013 [3]. While this was significantly lower than the 2003 rate [2], it remains a considerable challenge for public health. Additional data from Australia also show a 33% occurrence of rapid repeat pregnancy [4].

Unlike first-time pregnancy, subsequent pregnancy may result in greater physical, emotional, mental, and social burdens among adolescents. Repeat teenage pregnancy is related to the occurrence of antenatal complications such as small for

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gestational age, low birthweight infants, births defects, and sudden infant death syndrome [5] and has been found to triple the risk of stillbirths, preterm delivery, and infant mortality [5,6]. Furthermore, teenagers who deliver more than one child exhibit poorer health-seeking behavior, lower educational attainment, and poverty [6].

Given these outcomes, several interventions have been developed to prevent repeated teenage pregnancy. Corcoran and Pillai [7] conducted a meta-analysis of secondary pregnancy prevention programs for teenage mothers, which included school-based programs, home visitations, training, and cash assistance programs. Their review of 16 studies revealed a 50% reduction in the odds of repeated pregnancy (RP) for at least 19 months after the first pregnancy. They also found that the effects of the programs started to diminish after 31 months, which may still be considered beneficial as it went beyond the 24-month duration for optimal birth spacing.

The World Health Organization (WHO) emphasized the important role of community health worker (CHW) home visitations to the improvement of adolescent reproductive health [8,9]. The WHO last 1989 defined CHW as “any type of health worker who performs functions related to care... but has no professional, paraprofessional or tertiary education” [9]. On the other hand, a more recent WHO technical brief noted “CHW is often referred to... volunteer or salaried, professionals or lay health workers...” [8]. With this unclear definition, CHW can be regarded either as lay health workers or as paraprofessionals performing a voluntary, compensated, or paid community services.

CHWs may increase access to reproductive health services such as contraceptives [9–11], and provide counseling and health information among hard-to-reach and “hidden” adolescent mothers. Since CHWs and adolescents often come from the same community, sharing a similar social environment enables CHW to easily establish rapport, which facilitates the provision of services in an effective, acceptable, and appropriate manner. This helps in resolving the barriers hindering adolescents to openly discuss their problems [12]. Multiple controlled trials have shown that adolescent mothers visited by CHWs had significantly lower rates of RPs 2 years after their first delivery [2,5,12–16]. Black et al. [2] and Ownbey et al. [5] found that teen mothers who received at least two visits showed three times reduced risk of conceiving a second child.

Although CHW-based strategies have been recommended and proven in reducing subsequent adolescent pregnancy, Barnet et al. [17] and El-Kamary et al. [18] found no significant decrease in the risk of repeat pregnancy 24 months after the launching of the CHW, while a multisite evaluation by Kan et al. [19] found only a short-term effect. Inconsistency in the available evidence requires analyses capable of producing a consensus on the overall impact of CHW while also examining the various factors affecting the success of its implementation. Apart from the usual difference in study design and quality, characteristics of each CHW program especially the services being provided, CHW skills capacity and supportive supervision may influence the effectiveness of the intervention and explain heterogeneity among studies.

Despite the previous meta-analysis of Corcoran and Pillai [7] on secondary prevention programs, their results did not include estimates specific to CHW home visits and did not measure separate effect sizes for RPs and births. Furthermore, the most recent study they reviewed was published in

2003 suggesting the need for more specific and updated evaluation reports.

In this meta-analytic review, we aim to investigate the impact of CHWs in preventing separately repeated teenage pregnancies and births 2 years after first delivery and to evaluate how selected program characteristics may have affected the outcome. This addresses specific issues in previous reviews and meta-analyses by specifically looking at CHWs instead of pooling the effects of all prevention programs with more varied characteristics. This study also expands its analyses through disaggregation of the measured outcomes into pregnancy and births, together with extension of subgroup analyses in terms of program characteristics aside from the common methods aspects.

## Methods

### Search strategy

This systematic review used PubMed, Embase, CINAHL, MEDLINE, Web of Science, ScienceDirect, Scopus, PsycINFO, Social Work Abstract, and UQ Library, using key terms including community worker, community health worker, home visit, reduce, prevent, repeat, subsequent, teen, pregnancy, birth, and childbearing. Identified review articles were used to snowball other relevant literature. The Family Planning and Contraceptive Research bibliographies [20] were also consulted to expand the number of articles screened. Only articles in English language from January 1980 to May 2015 were taken into account, comprising journal articles and gray literature. We chose this period since no reviews has yet been conducted in this specific topic.

### Screening and selection

After removing duplicates, titles and abstracts were assessed for relevance using the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines [21]. Selected articles went through further screening. Only observational studies, quasiexperimental, and randomized controlled trials (RCTs) were included, all of which must have evaluated CHW home visitation program, aiming to reduce the occurrence of RPs and/or births within 2 years after the first pregnancy, among adolescents aged 20 years or younger. Studies which used the same data set were excluded. Erratum and review articles were also not included.

### Data extraction and quality assessment

At least two researchers independently extracted characteristics, participant information, and results and assessed the quality of each study. Inconsistencies were discussed and finalized before analysis. The Quality Assessment Tool for Quantitative Studies of Effective Public Health Practice Project was used to comprehensively assess the risk of bias of each study [22]. The Cochrane Review Group [23] and the Centre for Reviews and Dissemination [24] have both recommended this tool for evaluating the integrity of public health interventions specifically the methodological aspect of each study. Quality assessment was performed after data extraction to prevent bias during reporting of the results [25].

## Data analysis

The final articles went through narrative analysis which allowed grouping based on methods, intervention type, and result characteristics. Meta-analysis was then conducted to measure the overall impact of CHW to RPs and RBs using MetaXL (Epigear International, Sunrise Beach, Queensland, Australia) and Stata, version 13 (Stata Corp, College Station, TX). A random effects model was applied to estimate the pooled odds ratio (OR) for each outcome [25]. Heterogeneity was determined using Cochran's Q at .10 error and  $I^2$  statistic since these are sensitive but have less power in a small number of studies [26]. Egger's regression coefficient was calculated to evaluate publication bias.

Subgroup analyses were conducted to further examine how methodological (including quality) and programmatic factors (i.e., type of CHW, type of program, presence of supervisor) affected heterogeneity and the pooled OR. The methodological subgroups included study quality and type of control. Quality subgroups were rated "weak," "moderate," and "strong" based on the outcome of quality assessment. Studies were also divided into two groups depending on the type of control subgroups: (1) with intervention control and (2) without intervention control. Studies "with intervention control" compared CHW home-visiting programs with an existing program (e.g., Job Opportunities and Basic Skills Training Program, standard programs, usual care). Those "without intervention control" included studies which did not include any type of intervention. Articles which failed to mention the type of their control were included in this subgroup.

On the other hand, the programmatic set dissected the analysis by type of CHW, type of program, and presence of supervisor categories. Types of CHW included either "lay health workers" or "paraprofessionals." Articles were also grouped by the type of program whether the CHW program was "supplemental" (added to an existing program) or not. Presence of supervisor was divided into those which had and did not have a CHW supervisor.

## Results

### Overview of included studies

Of 557 articles found, only eight studies fully met our inclusion criteria. As shown in Figure 1, 383 of 421 articles without duplicates were removed during title and abstract screening because of nonrelevance of the topic, unavailability of the abstract, and being commentaries/editorials. During full-text screening, 30 from the 38 remaining records were excluded mainly because of different home-visiting intervention, being a review or erratum articles, and measurement of other outcome variables. An additional three studies were identified from six review articles, resulting in a total of 11 articles for which the majority were published after 2000 ( $n = 7$ ).

Interestingly, all the studies identified were conducted in the United States. Each CHW program identified was conducted in one of the states of the United States (Table 1). Some programs undertook a multiple-site implementation which included two or more states, and all CHW programs targeted communities with lower socioeconomic status and high teenage pregnancy rates. Six studies involved lay health workers, whereas the remaining five articles recruited paraprofessionals as CHWs.

### Community health worker programs and evaluation

Every program aimed to establish relationship with pregnant adolescents and/or teen mothers. Home visitations were performed regularly to engage with the individual situations of the teenagers. Each CHW was assigned with 10–15 adolescents and was deployed in the third trimester of pregnancy, or after birth when their first child was at most 3 months old. Programs required CHWs to conduct several home visits, with frequency ranging from 1–2 times weekly to 2–4 times monthly. Five programs delivered this intervention until the second birthday of the first child, two home visitations lasted for 6 months, whereas the remaining programs failed to mention the length of their intervention.

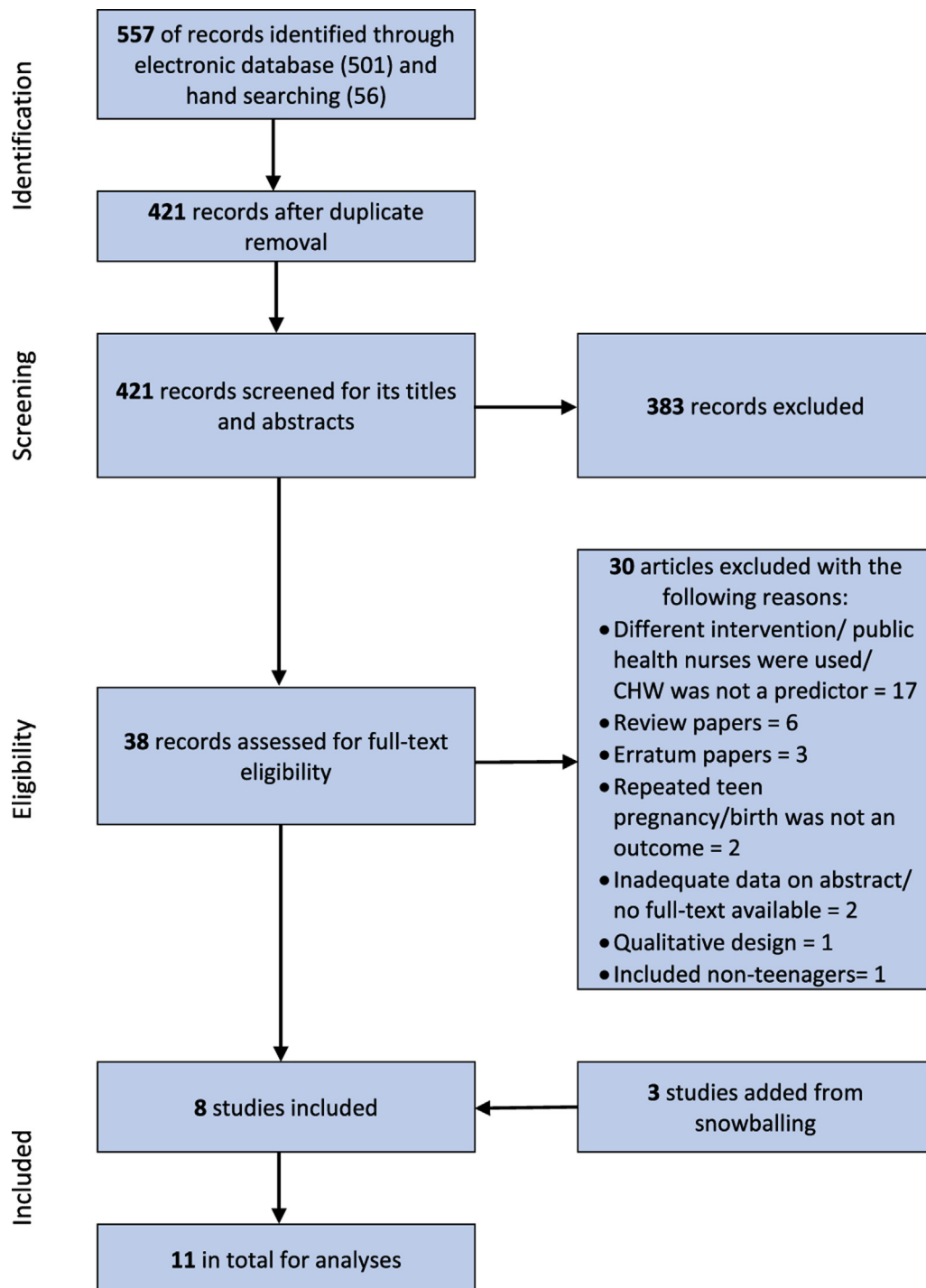
Five programs recruited their health workers, who were educated to at least a high-school graduate level, with experience in outreach activities and had a positive attitude toward family planning. CHWs residing in or near their target communities were preferred. All recruited CHWs were trained and expected to facilitate communication and interaction with the adolescents especially on sensitive issues. Two studies did not provide information on the eligibility criteria of their CHWs.

Home visitations of CHWs revolved on issues around adolescent reproductive health and child development. This included family planning and awareness of contraception, safe sexual practices, and other available health services that were discussed to motivate adolescents to avoid another pregnancy. CHWs provided information on parenting skills, infant stimulation, and child development; they encouraged teens to continue and complete their education and helped develop their coping skills in addressing personal and interpersonal problems. CHWs were also involved in the joint development of life goals and individualized plans.

Some CHW programs served as a supplement to an existing intervention. Kelsey et al. [27] enhanced its Job Opportunities and Basic Skills Training Program, an employment and cash assistance program, with the incorporation of CHW home visitations. Furthermore, Kan et al. [19] evaluated CHW effectiveness in addition to the 10 basic services of the Adolescent Life Program.

Most studies used either an RCT ( $n = 5$ ) or a quasiexperimental design ( $n = 4$ ), while the multiple-site evaluation by Kan et al. [19] considered both design types. Only the Sangalang et al. [16] used a retrospective cohort design. It was observed that >50% ( $n = 6$ ) of the articles used a comparator intervention as the control. The five remaining studies stipulated a "no-intervention control."

Table 2 shows that adolescents were typically recruited from health care institutions (i.e., hospitals, clinics), community centers, and/or referral from existing programs. Sample characteristics taken during the second year of evaluation showed that participants were mostly African-Americans, mostly attending 9th or 10th grade of high school. Nearly half of the studies ( $n = 5$ ) included 60–100 adolescents, whereas a third ( $n = 3$ ) comprised 600–800 adolescents. Sangalang et al. [16] analyzed >2,500 participants. All followed their participants for 2 years or until the second birthday of the first child. Retention rates at the end of the second-year follow-up ranged from 26.3% to 94.8% because of loss to follow-up and refusal to continue the program. Two studies [14,16] failed to report their retention rates.



**Figure 1.** Search strategy flow diagram.

### Results of studies

Outcome measures included RP and/or RB outcomes during the 24-month follow-up. Four of 11 studies considered both measures, while the remaining studies focused either on RP ( $n = 4$ ) or RB ( $n = 3$ ) alone. Five studies found a significant effect in the reduction of RP and RB in the intervention group. Sangalang et al. [16] selectively reported findings in the 12–16

age group as those in the 17–19 age group did not show significant results. Studies which concluded on an absence of CHW impact ( $n = 6$ ) attributed the nonsignificant result to the lack of confidence of CHWs, inadequate theoretical context of the program, and the presence of a comparator receiving another set of interventions. Three program evaluations which showed an increase in the odds of RP or RB did not provide further interpretation of these findings.

**Table 1**

Community health worker (CHW) home visitation program description, CHW eligibility, and length of intervention

Study	Program and setting	Program description	Eligibility of CHWs	Length of intervention
Barnet et al. [17]	Home-visiting program Economically disadvantaged areas in Maryland, USA	Each home visitor was trained to individually deliver parenting and adolescent curricula to 10–15 adolescents. These include child development, safe sexual practices, prevention of repeat pregnancy, violence, school engagement, and healthy relationships.	<ul style="list-style-type: none"> <li>• High-school degree</li> <li>• Experience related to health care, child development, or social work</li> <li>• Good interpersonal skills</li> </ul>	At least two visits per week from third trimester of first pregnancy until first birthday of the infant and at least once until the second birthday.
Black et al. [2]	Big sisters' home-visiting program Low-income communities in Maryland, USA	Each of the "Big Sisters" was visiting approximately 15 mothers. They discussed about "mother–daughter" relationship, personal values, decision-making for subsequent pregnancies, access to birth control, and goal setting. They also provided condoms every point of contact with the adolescent.	<ul style="list-style-type: none"> <li>• College educated</li> <li>• African-American</li> <li>• Single mother</li> <li>• Living independently</li> <li>• Raising one preschool child</li> </ul>	At least twice a month until the first birthday of the first child
Field et al. [14]	Parent-training program Low-income community in Florida, USA	Home visitors trained the adolescent mothers about infant simulation, care taking, and mother–infant interaction exercises.	<ul style="list-style-type: none"> <li>• Psychology graduate</li> <li>• Trained with Comprehensive Employment Training Act</li> </ul>	At least two visits a week for 6 months
Havens et al. [31]	Milwaukee Collaborative Teenage Pregnancy Prevention Program Wisconsin, USA	This mentoring program allowed the home visitors/mentors to build a relationship with a teenager and discuss with them health and contraception, continuing education, parenting, and budgeting. They also helped teens to cope with some of their personal problems. Each mentor was assigned with 15 teens in average.	<ul style="list-style-type: none"> <li>• Good experience with dealing adolescents</li> <li>• Considerable knowledge on community resources</li> <li>• Positive birth control attitude</li> </ul>	At least 12 hours per month interacting with adolescents for 2 years
Kan et al. [19]	Adolescent Family Life Program Multiple sites within USA	In addition to the 10 core services of the Adolescent Family Life Program, adolescents received home visits to deliver at hand counseling, preventive maternal services, nutrition, sexual health, pediatric care, coping, family planning and mental health information. Aside from home visits, the program also conducted school-based activities to 29% of its project sites.	<ul style="list-style-type: none"> <li>• Not mentioned</li> </ul>	At least once every 2 weeks for 2 years
Kelsey et al. [27]	Inclusion of Home visitor services with Job Opportunities and Basic Skills Training Program (JOBS) Chicago, Ohio and Oregon, USA	Home visitor services were supplemented to JOBS in increasing the attainment of its outcomes. Home visitors or paraprofessionals had frequent interaction with their assigned teens to enable a more intimate relationship with them. They are teaching parenting skills, effective family planning, and community resources for health care. They also referred women who need immediate care.	<ul style="list-style-type: none"> <li>• Do not have specific professional training on program key areas</li> <li>• Have desirable attributes to facilitate access to adolescent health services</li> </ul>	From 45 minutes to 1 hour every week for at least 24 months
Ownbey et al. [5]	Healthy Families Home Visitation Program North Carolina, USA	Family Support Workers (FSW) which has a caseload of 15–20 adolescents each. FSW facilitated development of Individual Family Service Plan, built a strong trusting relationship with their teen as well as emphasized education, child development, parenting and access to community resources.	<ul style="list-style-type: none"> <li>• Nondegred (high school, college undergraduate)</li> <li>• Able to address sensitive issues to adolescents</li> </ul>	From 6 months to 5 years
Polit and Kahn [37]	Project Redirection Multiple sites within USA	Community women were used to support adolescents toward their personal goals in form of individualized participant plan. Aside from home visiting, peer group session were also done to assist adolescents with their social and personal problems	<ul style="list-style-type: none"> <li>• Residing in the project site</li> </ul>	Not mentioned
Sangalang et al. [16]	Adolescent Parenting Program (APP) North Carolina, USA	Each home visitor was assigned to 12–20 first-time pregnant or parent adolescents. Their goal was to help adolescents develop their personal goals, provide case management, and conduct individual counseling. They motivated teens to avoid secondary pregnancy, continuous participation, practice good reproductive health.	<ul style="list-style-type: none"> <li>• Graduate of social work, psychology, or sociology</li> </ul>	From three to four times a month for 18 months

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**Table 1**  
Continued

Study	Program and setting	Program description	Eligibility of CHWs	Length of intervention
Sims and Luster [28]	Family Support Program Michigan, USA	This intensive program provided home visitations of family advocates. They gave information about the community services and care for their children, delivered emotional support, and encouraged mothers to pursue their life goals and finish education. They also accompanied teenagers to access service in the community and help them filling-out necessary health facility forms for nonliterate mothers. Each advocate was assigned with 12 adolescents.	<ul style="list-style-type: none"> <li>• Not mentioned</li> </ul>	Not mentioned
Solomon and Liefeld [40]	Family Growth Center Poor urban neighborhood in Pennsylvania, USA	Family Growth Center (FGC) has social workers and prenatal counselors recruited from the project sites. They provided social support, crisis intervention, and parenting support services to their assigned clients. These home visitors also conducted bimonthly parenting classes. Ecological approach (context of family and neighborhood) was followed.	<ul style="list-style-type: none"> <li>• Respected older indigenous woman</li> <li>• From the community where they are assigned</li> </ul>	Until 6 months after delivery of the first infant of the adolescent

### Quality assessment results

Six studies were rated as “moderate” quality, whereas others either showed strong ( $n = 3$ ) or weak ( $n = 2$ ) quality (Supplementary Figure). Of the five studies with significant results, only two exhibited rigor in all components of their methodology. The remaining three studies had moderate ( $n = 2$ ) and weak ( $n = 1$ ) quality as they failed to adjust their effect estimates for confounders.

Kelsey et al. [27], Sims and Luster [28], and Ownbey et al. [5] used CHW supervisors/coordinators to coach and monitor the home visitors to ensure consistent function and interaction of CHWs with their assigned adolescents. However, the evaluation of intervention integrity exposed the under-reporting of consistency of intervention implementation in most studies. Risk of contamination was found present among the control groups due to area proximity between the two groups. Contamination may lead to difficulty in the detection of program impact as the control groups tend to receive interventions from the program through other channels (i.e., relatives, friends).

### Results from the meta-analysis

The random effects analysis of eight studies (2,651 adolescents) showed a nonsignificant 4% reduction in the odds of having an RP (OR = .96; confidence interval [CI] = .70–1.28; Figure 2). Significant low levels of heterogeneity were also noted ( $Q = 13.49$ ,  $p = .06$ ,  $I^2 = 48\%$ ). Results from the quality subgroup analysis (as shown in Table 3) revealed pooled OR and heterogeneity in the moderate subgroup similar to the overall OR. Studies without an intervention control demonstrated a significant OR of .31 (CI = .10–1.00) and an absence of heterogeneity. The remaining categories of quality and their respective subgroups still showed nonsignificant ORs and varying levels of significant heterogeneity.

A 30% (OR = .70, .49–.99; asymptotic  $z = -2.001$ ,  $p = .045$ ) overall decrease in the odds of RB was found. The seven studies (3,635 adolescents) included in this meta-analysis showed a significant heterogeneity of moderate magnitude. There was a significant reduction of RB among moderate (OR = .69, .49–.97) and strong (.73, .57–.95) quality subgroups. Heterogeneity in these subgroups was found negligible with an  $I^2 = 0$  and  $Q$   $p$  value of particularly above the 10% margin. Conversely, those in the weak subgroup indicated a nonsignificant OR. “Without intervention control” subgroup depicted a substantial decrease in odds (OR = .48, .23–.97) of RB. It can be seen that this was also observed in analysis of RP. The small number of studies in this subgroup, however, meant the pooled effect size was not as robust.

Lay health worker subgroup showed a significant pooled OR of .69 (.49–.97). Moreover, four very homogenous ( $Q = 1.85$ ,  $p = .6$ ,  $I^2 = 0$ ) studies without a CHW supervisor had a more precise estimate (.71, .58–.88). The nonsupplemental subgroup, which contained all but the study by Kelsey [27], revealed that CHW reduced RP by almost 40% odds (OR = .63, .48–.84) with nonsignificant heterogeneity.

Sensitivity analyses (Supplementary Table) among studies with RP outcome showed minimal changes in its pooled estimate. Although exclusion of the multisite evaluation by Kan et al. [19] reduced pooled OR from .96 to .87, this estimate is still not statistically significant. On the other hand, removing Kelsey [27] in the meta-analysis of RB resulted in a more precise pooled OR

**Table 2**

Study design, follow-up, results, and quality

Study	Sample (during second-year evaluation)	Design, follow-up period, and retention rate	Key findings	Significant confounders	Quality rating
Barnet et al. [17]	<b>Sixty-three</b> pregnant adolescents aged 12–18 years (mean age = 16.9) whose pregnancies were of at least 24 weeks of gestation recruited from three urban University of Maryland affiliated prenatal care sites. Most of them were African-Americans.	<b>Random assignment</b> of adolescent to intervention and comparison (usual care) groups. Evaluators were blinded during data collection. <i>Follow-up: 1 and 2 years</i> <i>Retention rate: 51.6%</i>	<i>Outcomes measured: adjusted odds ratio (AOR) of repeated pregnancy (RP) and repeated birth (RB)</i> Evaluation showed no significant improvement on RP (AOR = 1.2, 4–3.5, $p = .69$ ) and RB (AOR = .6, .2–2.6, $p = .54$ ) 2 years since the program started. It was explained that the program lacked motivation approaches to obtain “sustainable decision” to limit conception.	<ul style="list-style-type: none"> <li>Frequent use of condoms in the past 12 months (AOR = 3.6)</li> <li>In school or graduated at Year 2 (AOR = 3.5)</li> </ul>	Moderate
Black et al. [2]	<b>One hundred and forty-nine</b> low-income, adolescent mothers who were currently residing with their mother, at most aged 18 years (mean age = 16.3), African-Americans, and had no indication of heroin, cocaine, and chronic illness which would interfere parenting or adolescent development. Participants were predominantly on their 10th grade and of good relationship with the father of their child (70%).	<b>Randomization</b> was done to assign adolescents to treatment and control (no further contact until evaluation visits). <i>Follow-up: 6 months, 13 months and 24 months</i> <i>Retention rate: 82.3%</i>	<i>Outcomes measured: AOR of RB</i> Analyses revealed that adolescent mothers in the control group gas 2.45 (1.003–6.03, $p < .05$ ) more odds to have RB than those in the home-visited groups during second-year assessment. Although only 40% received more than eight visits, those with at least two visits still had 3× less the risk of RB.	<ul style="list-style-type: none"> <li>None</li> </ul>	Strong
Field et al. [14]	<b>Sixty-one</b> black teenage mothers aged 13–19 years (mean age = 16.3) from low-income households were recruited from a large university neonatal hospital. Only those without perinatal complications were included.	Participants were <b>randomly assigned</b> to program and comparison or no-intervention groups <i>Follow-up: 4 months, 8 months, 1 year, and 2 years</i>	<i>Outcomes measured: proportion of RP</i> During the 2-year assessments, occurrence of repeat teen pregnancy in the intervention group (27%) was significantly lower than the control group (39%) with a $p$ value $< .05$ . Despite of the program's focus on infant, it had a “hidden benefit” to prevent further pregnancy among teen mothers. One-year assessment also revealed same pattern (9% vs. 19%, $p < .05$ ).	<ul style="list-style-type: none"> <li>Confounders were not considered during analysis.</li> </ul>	Moderate
Havens et al. [27]	<b>Ninty-eight</b> unmarried teenagers, with an age ranging from 12 to 19 years (mean age 16.5), during her third trimester of her first pregnancy were included from community hospitals, schools, health centers, and private clinics. Large proportion is African-Americans.	<b>Randomization</b> was used to allocate adolescents to treatment and control (receiving assistance only from community agencies and family/friends). <i>Follow-up: 6, 12, 18, and 24 months postpartum</i> <i>Retention rate: 89.1%</i>	<i>Outcomes measured: proportion of RP</i> The program has no significant impact on repeat pregnancy after 2 years of implementation. Mentoring group had 66%, whereas the control group had 68.8%. In each group, there was almost same proportion with one RP (40%), two RPs (23%–24%), and four RPs (2%–5%). It was suggested that the high rates of RP in the mentoring group was due to the program failure to address sexual health issues. Community health worker (CHW) only tackled education and relationship issues instead of more sensitive topics.	<ul style="list-style-type: none"> <li>Confounders were not considered during analysis.</li> </ul>	Moderate

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**Table 2**  
Continued

Study	Sample (during second-year evaluation)	Design, follow-up period, and retention rate	Key findings	Significant confounders	Quality rating
Kan et al. [19]	<b>Seven hundred and ninety-four</b> adolescents aged 12–19 years (mean age = 17) and able to read English or Spanish. About 50% was African-American while most from comparison groups were older and had higher educational attainment.	This multiple-site evaluation performed <b>either randomization or not</b> depending on the project area. The comparison group received the 10 core services of the project without home visitation. <i>Follow-up: within 12 months and after 12 months from baseline</i> <i>Retention rate: 54.2%</i>	<i>Outcomes measured: AOR of RP</i> Study showed that the program brought no significant reduction on RP after 24 months (AOR = 1.39, .84–2.30) unlike during its first year (AOR = .73, .55–.97). With these, it was concluded that the program only had a short-term impact toward RP. Study did not provide explanation regarding this result.	<ul style="list-style-type: none"> <li>• Age</li> <li>• Currently pregnant/parenting</li> <li>• Educational attainment</li> </ul>	Moderate
Kelsey et al. [27]	<b>Seven hundred and eight</b> childless, pregnant adolescent younger than 19 years (mean age = 18.2). They must also be approved from Medicaid for their unborn child and currently receiving cash assistance. Almost all are African-American, non-Hispanic, finished 10th grade but currently not enrolled in school.	Teens were <b>randomly assigned</b> to intervention and control groups (only Job Opportunities and Basic Skills Training Program [JOBS]). JOBS provided monetary incentives to teens but does not directly influence fertility control, lifestyle, housing, parenting, and child care. <i>Follow-up: 24 and 27 months</i> <i>Retention rate: 26.3%</i>	<i>Outcomes measured: adjusted impact and percentage change of RP and RB</i> Despite of the program influence on increase condom use and passive contraceptives, there were no observed significant change in RP (Impact 4.8, $p = .20$ ) and RB (Impact=4.3, $p = .12$ ) during the second birthday of the first child of the adolescents. There was actually nonsignificant increase in RP and RB in the home visitor services group than the control group (JOBS) with a percentage change of 14% and 31.2%, respectively. These results were attributed to the incapacity of the home visitors to address sexual health problems and to provide sensitive family planning information.	<ul style="list-style-type: none"> <li>• Age of first child in months</li> </ul>	Weak
Ownbey et al. [5]	<b>Two hundred and twenty</b> pregnant or currently teen parents with an infant younger than 3 months, aged 13–19 years, with at least late prenatal care compliance or with incidence of abortion or adoption were recruited from health care institutions.	This postintervention measurement only study <b>did not involve randomization</b> . Those assigned to control group were not receiving any intervention, and those cannot be included due to limited slots. <i>Follow-up: 24 months</i> <i>Retention rate: 94.8%</i>	<i>Outcomes measured: proportion of RB using chi square</i> Healthy families program resulted into a significant positive effects on reduction of RB ( $\chi^2 = 8.87$ , $df = 1$ , $p = .0029$ ). Teen mothers in the treatment group (8.9% vs. 26.9%) were 67% less likely to experience another pregnancy 2 years after their first live birth.	<ul style="list-style-type: none"> <li>• Confounders were not considered during analysis.</li> </ul>	Weak
Polit and Kahn [37]	<b>Six hundred and seventy-five</b> adolescents who are aged 17 years or younger (mean age = 16.4), either pregnant or parent, did not complete high school, from low-income family and either receiving or eligible for welfare assistance included were referrals from community service or word of mouth. Fifty percent were African-American, and 60% were currently pregnant during the start of the program.	This study <b>did not use randomization</b> in which the control group received services as a participant of the Office of Adolescent Pregnancy Program. <i>Follow-up: 12 and 24 months</i> <i>Retention rate: 85.6%</i>	<i>Outcomes measured: adjusted risk difference (ARD) of RP and RB</i> In contrast with the first year of implementation (ARD = $-6$ , $p < .05$ ), this CHW program revealed no significant difference in the proportion of RP (ARD = $-4$ , $p > .10$ ) and RB (ARD = $-7$ , $p < .10$ ) between the intervention and comparison groups after 2 years. This only showed that the program can slightly delay occurrence of RP for 2 month based on tobit analysis. This findings were attributed to the almost equal rate of contraceptive use between the two groups.	<ul style="list-style-type: none"> <li>• Race (Puerto Rican, African-American)</li> <li>• Enrollment in Aid to Families with Dependent Children Program</li> </ul>	Moderate

(continued on next page)



**Table 2**  
Continued

Study	Sample (during second-year evaluation)	Design, follow-up period, and retention rate	Key findings	Significant confounders	Quality rating
Sangalang et al. [16]	Records of <b>2,520</b> adolescents aged 12–19 years from North Carolina were obtained. Adolescents in the treatment group were recruited from social service, schools, and juvenile courts. Some were snowballed from current program participants. Most were African-American.	This used a retrospective cohort design wherein those from the treatment group were matched with communities not involved in the program. Only the records were collected for of the comparison group. <i>Follow-up: 2 and 4 years after birth of first child</i>	<i>Outcomes measured: adjusted relative risk ratio (ARRR) of RB</i> Study results showed that adolescent aged 12–16 years from the intervention group had less occurrence of RB than the control group (ARRR = -.229, standard deviation = .083, $p = .006$ ) 2 years after the delivery of their first child. After 4 years, 66% from the APP group still did not have any RB compared with control group (66%). Adolescent from 17 to 19 age group did not show any significant results. The study did not show more details about this. Although the study revealed promising findings, inferences must be made with carefully made because of the design used (nonexperimental).	<ul style="list-style-type: none"> <li>• Race</li> <li>• Age at first birth</li> </ul>	Strong
Sims and Luster [28]	<b>Ninety-nine</b> expectant or currently adolescent mother of 13–19 years old (mean age = 16.2) were included. Generally, participants were African-Americans and unmarried.	<b>Random assignment</b> was done to intervention and comparison (standard health programs) groups. <i>Follow-up: 24 months</i> <i>Retention rate: 69.7%</i>	<i>Outcomes measured: proportion of RP and RB using adjusted Wald statistic (AWS)</i> Analyses of 24th month data showed that being in the treatment group is not a significant predictor to reduce RP (AWS = .02, $p = .89$ ) and RB (AWS = .89, $p = .50$ ) despite of low occurrence (RP = 58%, RB = 33%) compared with control group (RP = 63%, RB = 39%). Study attributed the results to presence of a “control group with intervention” instead of “no-intervention control.” In addition, it mentioned that the low employment opportunity in the study setting may also prevented the program to optimize its effects.	<ul style="list-style-type: none"> <li>• Living with male partner</li> </ul>	Strong
Solomon and Liefeld [40]	<b>Sixty-three</b> first-time adolescent mother younger than 19 years participated while most of them are currently enrolled in nutrition supplement program. Most adolescents in the intervention group were from minorities.	Allocation to treatment and control groups did <b>not involve randomization</b> . Control group, receiving no intervention expect for phone call reminders for immunization and information update, was matched being outside the zip codes of yet almost adjacent to a treatment area. <i>Follow-up: 12, 18, 24, and 36 months</i> <i>Retention rate: 28%</i>	<i>Outcomes measured: proportion of RP using chi square</i> Two years after program enrollment, adolescents in the intervention group significantly had lower proportion of RP (<10%) unlike the control group (38%; $\chi^2 = 7.67$ , $p = .006$ ). Same result was found during the 3-year assessment ( $\chi^2 = 5.40$ , $p = .020$ ).	<ul style="list-style-type: none"> <li>• Confounders were not considered during analysis.</li> </ul>	Moderate

Values in bold represent participant assignment for experimental studies; italics indicate follow-up periods, retention rate, and outcomes measured.

**Table 3**

Community health worker (CHW) toward repeated teenage pregnancies and births: random effects meta-analysis by selected methodological and program characteristics

Subgroups	Repeated pregnancies						Repeated births					
	n	Pooled ES		Heterogeneity			n	Pooled ES		Heterogeneity		
		OR	95% CI	Q	p value	I <sup>2</sup>		OR	95% CI	Q	p value	I <sup>2</sup>
Quality												
Weak	1	1.23	.90–1.67	NA	NA	NA	2	.63	.13–3.12	12.26	0	92
Moderate	6	.86	.57–1.30	11.3	.05	56	2	.69	.49–.97	.01	.92	0
Strong	1	.83	.37–1.86	NA	NA	NA	3	.73	.57–.95	1.79	.41	0
Type of control												
With intervention	6	1.07	.90–1.28	4.97	.42	0	4	.89	.58–1.38	6.51	.09	54
Without intervention	2	.31	.10–1.00	1.73	.19	42	3	.48	.23–.97	7.06	.03	72
Type of CHW												
Lay health worker	5	.91	.58–1.42	10.15	.04	61	2	.69	.49–.97	.01	.92	0
Paraprofessional	3	1.01	.66–1.54	2.77	.25	28	5	.68	.41–1.12	15.75	0	75
Type of program												
Supplemental	3	.96	.53–1.76	8.32	.02	76	1	1.37	.91–2.06	NA	NA	NA
Nonsupplemental	5	.86	.66–1.10	1.65	.8	0	6	.63	.48–.84	7.21	.21	31
Presence of supervisor												
With supervisor	2	1.17	.88–1.56	.79	.38	0	3	.69	.26–1.82	12.53	0	84
Without supervisor	6	.86	.57–1.30	11.33	.05	56	4	.71	.58–.88	1.85	.6	0
Overall	8	.96	.72–1.28	13.49	.06	48	7	.70	.49–.99	16.37	.01	63

CI = confidence interval; ES = effect size; n = number of studies; NA = not applicable; OR = odds ratio.

while further reducing the risk of RB from .70 (.49–.99) to .63 (.48–.84). Meta-analyses of both outcomes displayed absence of publication bias with a coefficient of  $-1.37$  both for RP ( $p = .18$ ) and RB ( $p = .35$ ).

## Discussion

Our systematic review and meta-analysis found that CHWs' involvement with adolescents led to a 30% reduction in the risk of RB among teenagers 2 years after their first pregnancy while no significant reduction was found regarding RP. Studies looking into RP had more diverse (increasing and decreasing) and nonsignificant ORs than studies of RB.

### Community health workers in adolescent reproductive health

Recent evidence and policies recommend the deployment of CHW as an effective intervention to improve not only adolescent reproductive health but also a broader range of maternal–child health outcomes, with some of the strongest evidence contributed by a recent RCT which found a clinically significant delay of subsequent adolescent live births [12]. This CHW program provided comprehensive social and family planning support, promoted prevention of another pregnancy, and encouraged adolescents toward health-seeking behavior. A comprehensive systematic review of 82 studies depicted CHW as an effective intervention to improve child immunization and nutrition [29]. CHW lessens the burden of health professionals in reaching out to households in remote areas [8,30].

The crises arising from adolescent pregnancy and parenting may disrupt normal life processes and lead to loss of personal goals. The reengagement of which requires motivational interventions with individually tailored counseling and emphasis on attainment of life ambitions and autonomy. CHWs can provide these services and deliver related outcomes beyond the caregiver–patient relationship. CHWs can assume a supportive role [10] designed to create a sustainable relationship and motivate adolescents to pursue their life goals [6].

### Programmatic and methodologic issues

Despite the positive influence of CHWs, some programs were not able to attain the intended outcomes. This current review found that noneffective programs needed more concrete promotion strategies directly targeting secondary pregnancies rather than a broader approach [17,19,27,31]. A strong contextual basis may play a role in the achievement of CHW program objectives [5,17,27]. An appraisal of CHW training manuals revealed an absence of clear instructions on how to communicate fertility-related issues and subsequent birth prevention strategies [18]. Various evaluations have suggested the need to anchor activities within tangible concepts such as socio-cognitive frameworks, developmental theory, and resilience models [2,11,32,33].

Failure of CHW programs has been also related to the absence of supportive supervision and monitoring [8,29,34]. However, findings from this review suggest these issues may not be as relevant as previously anticipated. CHWs without ongoing supervision effectively lowered RB and RP, suggesting that the presence of a supervisor does not guarantee effective CHW management, but rather depends on the functions performed by the supervisors. Supervisory support given in the studies often focused on data collection rather than performance evaluation and feedback [34]. Furthermore, expanding the scope of a teen mothers program did not show the expected improvement. Evaluation of CHW as a supplemental intervention tended to be less effective. Being an auxiliary program may increase burden and set impractical expectations among CHWs. Establishing too high expectation may also lead to an unsuccessful CHW program [8,29]. The original program with which the CHW program was supplemented may also reduce the effectiveness of the CHW program in cases where the original program itself is known not to be effective.

Methodological issues such as weak study design, high attrition rate, and poor sampling techniques may have also affected findings [5,18], and we found that quality greatly influenced the pooled results. “Moderate” and “strong” quality

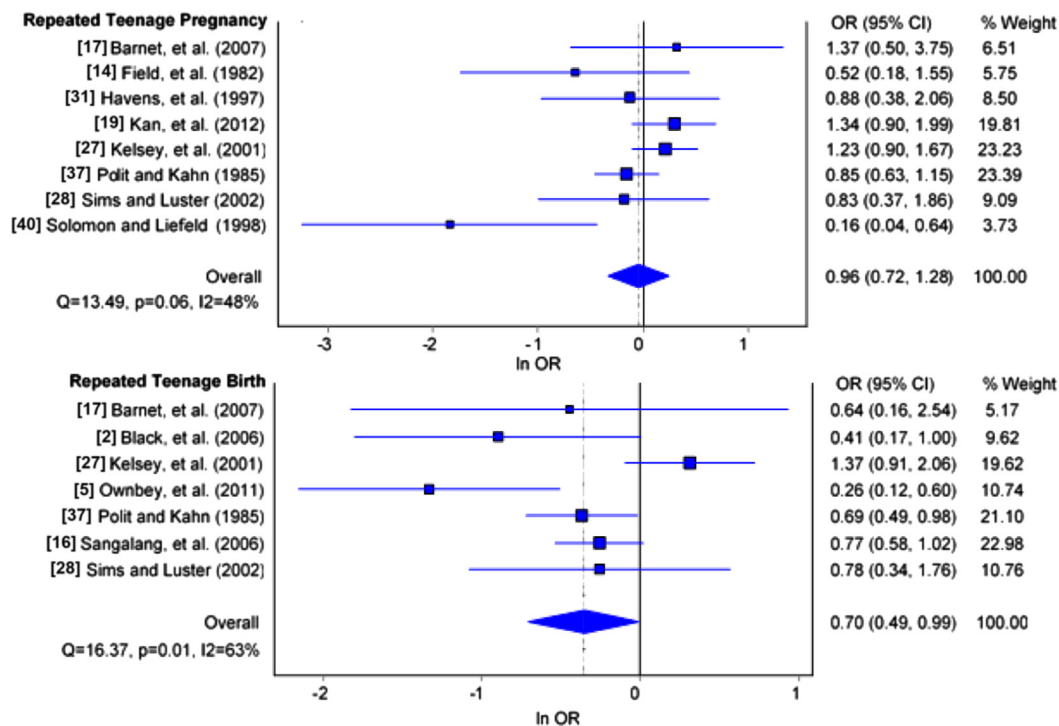


Figure 2. CHW toward repeated teenage pregnancies and births: random effects meta-analysis.

subgroups exhibited a significant reduction of RB in addition to a negligible level of heterogeneity. A significant adjustment of pooled OR and narrowing of CIs were also observed after separation of low-quality studies.

Evaluation of CHW programs were also at risk for intervention inconsistency and contamination. Selected studies used control sites which were adjacent to the CHW sites. With the absence of effective program monitoring, it was not determined whether adolescents in the control group unintentionally received CHW home visits and if all the adolescents in the treatment group received the same number of visitations. Presence of contamination may underestimate the true effect of the intervention [35]. Although some studies used clustered randomization to avoid this [35,36], no measure was used to ensure intervention integrity until the last year of follow-up.

### Limitations

Although this review aimed to include programs from different countries, database searches only found U.S.A.-based programs; meaning, the findings offer only limited insight to the potential of success should similar programs be implemented in low- and middle-income countries (LMICs). Although the selection of lower socioeconomic communities in the United States may somewhat extend the generalizability of our findings to LMICs [29], there are still other factors (i.e., health systems, policy approaches) which are likely to confound the program dynamics.

Subgroup analyses diminished the magnitude of heterogeneity among each subgroup, clearly showing factors which might influence effectiveness of CHWs. However, subgrouping further reduces the number of studies decreasing the robustness of

estimates in each subgroup. Formulating broad views must be done with caution because of varying levels of heterogeneity and the small set of studies. Similar to other comprehensive program reviews [7,29], unavailability of other program information restricted the intervention typologies in meta-analysis which may include frequency and duration of CHW home visits, caseloads or CHW-to-client ratio, adequacy of incentives, and other variables which might impact effectiveness and sustainability.

### Implications and future research

CHWs was found effective to reduce the occurrence of RBs among adolescents especially in low-income communities. Despite of this finding, this review was limited to studies conducted in United States. While recent programs have started to focus on specific interventions in community health [29], the 2015 WHO guidelines for CHW implementation still do not reflect specific strategies for adolescents and adolescent mothers [8]. Mapping of CHW training resources also highlighted that no published materials are dedicated to adolescent and reproductive health and sexuality because of the inability of CHW to effectively address sensitive and stigmatizing issues [34].

These therefore demand development and evaluation of CHW programs in LMICs which may have greater risk for repeated adolescent pregnancy. The WHO similarly suggested that further research is necessary to assess feasibility and effectiveness of social support interventions and contraceptive program to reduce repeated teenage pregnancy in developing countries [10]. Instead of RCT, observational studies may be performed as an alternative method of measuring the effect of CHW exposure. Aside from childbearing outcomes, programmatic issues, such as

operations and sustainability, must also be considered to obtain a complete picture of the program.

Comparative analysis between lay and paraprofessional CHWs, aimed at dissecting the good practices which may differ between the two groups, can be undertaken to improve each type of home visitor. However, the studies included in this review did not adequately define their CHWs (i.e., paraprofessional or lay). Future studies should include a clearer definition to make such analyses possible.

Evaluation of the 11 studies highlighted a number of points by which CHW programs may be improved. Polit and Kahn [37] emphasized that long-term impact should not be expected out of short-term CHW home visits. Deep and sustained relationship [38] aside from health promotion and counseling at home can help in delaying another pregnancy among adolescents. It has been suggested that continuous interaction and family planning advice 24 months after the first pregnancy is one of the essential components of strong social support [39]. Involvement of males or teenage fathers is also an effective strategy for CHWs. As teenage fathers separate themselves because of confusion with regards to their role as a provider [39], addressing their emotional needs may facilitate mutual decision toward parenting and prevention of RP.

Home visitations of CHWs were found to be an effective intervention toward the prevention of subsequent childbearing among adolescents. However, the limited available evidence, especially in LMICs, stresses the need for the development of CHWs aimed at reducing RP and RB outcomes. Further investigations and program modifications are necessary to establish more reliable context concerning CHW potential on the promotion of adolescent reproductive health.

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## Supplementary Data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jadohealth.2016.05.011>.

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