The Effect of Prenatal Home Visiting for Adolescent Mothers on Maternal and Neonatal Outcomes: A Systematic Review and Meta-Analysis

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Abstract

Background
Adolescence pregnancy is high risk both for mother and child. This systematic review aimed to determine the effect of home visiting on maternal and neonatal outcomes in adolescent mothers.

Materials and Methods
This systematic review was performed by searching English databases including Cochran library, Web of Science (via PubMed), Google scholar, Scopus, web of science, Embase, Ovid and Persian databases including SID, Magiran, and Barakat Knowledge Network System without time limitation. The search terms included "adolescent or teen pregnancy", "adolescent or teen mothers", "home visiting", "home visitation" and "home visit".

Results
According to databases search, 967 papers were found that among them 913 papers were not related. Among 54 related papers, 44 abstracts and 10 full texts were studied. At the end, 7 RCT included in this systematic review. The meta-analysis result done on 375 person indicated that mental health in the home visiting group was significantly better than the control group (routine care or cares except considered intervention) (standard mean difference: -0.33; 95%CI: -0.57 to -0.10; p=0.006, I^2=0%). Also, meta-analysis done on 185 persons showed that there was no significant difference between two groups in terms of repeat pregnancy (odds ratio: 0.82; 95% CI: 0.33 to 2.03; p=0.67; I^2=50%), and repeat birth (odds ratio: 0.90; 95%CI: 0.35 to 2.31; P= 0.820, I^2=0%).

Conclusion
Results indicates that home visiting can improve mental health but does not have any effect on repeat pregnancy and repeat birth. Clinical trials with accurate methodology by controlling effect of number and duration of home visiting are recommended.

Key Words: Adolescent, Women, House Calls, Pregnancy, Meta-Analysis.

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1- INTRODUCTION

Adolescence is considered one of the most important age groups in any society, and the health of adolescents is an essential foundation for a society's health (1). According to the World Health Organization (WHO), years between 10 to19 are considered as adolescence (2). A number of studies regarding adolescent health reported high prevalence of certain risk factors in them such as obesity (3), physical inactivity (4), smoking (5) and improper nutritional behaviors (6) in adolescence. Therefore, pregnancy in adolescents is dangerous for mother and fetus. Annually, around 16 million pregnancies among fifteen to nineteen years old girls and 2 million pregnancies in girls under fifteen take place, which around 95% of them happen in low and middle income countries (7). According to the World Bank, the adolescent fertility rate in Iran equal with 26 births per 1,000 women ages 15-19 (8). Adolescence pregnancy is public health issue which effects adolescent mothers, infants and at macro level, the community (9). Early marriage, dropout, lack of knowledge about contraceptive methods, inadequate education about sex issues and sexual violence are effective factors on adolescent pregnancy (7).

Adolescence pregnancy is high risk both for mother and child. In underdeveloped and developing countries, pregnancy and delivery can lead to adolescents' death (10, 11). Adolescents' pregnancy can lead to increased incidence of preeclampsia, eclampsia, low birth weight, congenital anomalies, stillbirth, intrapartum death, abortion, preterm labor, puerperal endometritis, systematic infection and neonatal complications (1, 12). Repeat pregnancy rate in the first two years after delivery is greater in adolescent mothers; 25% during first year, and 35% during second year after delivery become pregnant again (13).

Prenatal care is a comprehensive program for care before birth which includes coordinated and integrated approaches to medical care and psychosocial supports that in optimal situation starts before pregnancy and continues till delivery (14). Adolescents are in danger of getting late or even missing prenatal routine cares (13) so they need of help, support and guidance of people that can visit them at home. Home visiting is an approach to provide such helps and includes interventions other than medical cares which simplifies access and usage of social and health services by women in risk of undesirable pregnancy outcomes (15). By prenatal home visiting, high risk pregnant women can receive nonmedical interventions such as care coordination, emotional support and education by home-visitor who is usually a nurse, midwife or a social worker. Most prenatal home visiting programs are based on public health departments, social clinics or social service agencies (16). Home visitation is a strategy to improve birth outcomes among pregnant women who may lack social supports and could not get help out of home (17).

Positive effects of home visiting on maternal and neonatal outcomes are shown in some researches. In a descriptive study by Middlemiss and McGuigan (2005) was shown that home visiting improved mother-child relationships and also increased parental skills and increased parental skills could increase their ability to control stress (18). Lee et al.'s study (2009) showed that prenatal home visiting by focusing on social support, health education and access to service provider can decrease LBW (low birth weight) in high risk women and adolescents (19). McKelvey et al. (2012), in a semi-experimental study showed that home visiting improved parental skills (20). Also, Ichikawa et al. (2015) in a semi experimental study showed that although home visiting program may prevent

preterm delivery but it did not have any effect on preventing small for gestational age (SGA) (21). The results of Mistry et al.'s study (2016) indicated home visiting program has positive effects on outcomes such as healthy baby at birth and repeat birth (22). Samankasikorn et al. (2016) showed that home visiting increases self-esteem, and also cause better parenting (23). A review study (2011) regarding prenatal home visiting effect on improving birth outcomes has been done. In this review, it is shown that prenatal home visiting might improve prenatal cares but there were little evidences to show improvement on birth weight or gestational age at delivery. In the mentioned review study, both adolescents and non-adolescents were considered (24).

Since pregnancy during adolescence is not only a risk factor for undesired pregnancy outcomes but also has negative effects on maternal-neonatal well-being in future (25, 26). Despite the importance of prenatal care on pregnancy, we did not find any systematic review paper with aim of determining the effect of prenatal home visiting on maternal-neonatal outcomes in pregnant adolescents in the world and Iran, so the aim of this systematic review was to determine the effect of prenatal home visiting on maternal-neonatal outcomes in pregnant adolescents.

2- MATERIALS AND METHODS

2-1. Objective

The aim of this study was to evaluate the effect of prenatal home visiting on maternal-neonatal outcomes in adolescent mothers.

2-2. PICO

The defined Population, Intervention, Control, Outcome (PICO) for this review study was as follow:

Types of participants: Pregnant adolescents between ages 10 and 19 years old. Intervention: Prenatal home visiting method was provided for intervention group and no intervention was provided for control group or they received routine care or education and cares except considered outcomes.

Outcomes: Primary outcome was mental health and secondary outcomes in this systematic review were as follow:

- Parenting knowledge,
- Repeat pregnancy,
- Repeat birth,
- Gestational age at delivery,
- Birth weight,
- Maternal weight gain during pregnancy.

2-3. Search methods to identify studies

In this systematic review, randomized clinical trials (RCT), published in Persian and English, was considered. Research was done according to following keywords: "Adolescent OR Teen pregnancy", "Adolescent OR Teen mothers", "Home visiting", and "Home visitation", "Home visit". This systematic review was performed by searching several databases including Web of Science (via PubMed), Cochrane library, Scopus, Embase, Google Scholar, Ovid, Science Direct, SID, Magiran, and Barakat Knowledge Network System. Two authors (TH and SG, PhD students of Midwifery) searched the databases independently and the collected data including title, date of publication, and authors name of articles and were recorded in a checklist.

We also searched the references in reviewed articles for RCTs comparing home visiting with routine care during pregnancy. In addition to mentioned data bases, references of selected papers were also considered. In total, 967 topics with above keywords were found that 913

papers were not related by considering the topic. Among 54 papers with related the topic of home visiting among adolescent mothers were found which topics, 44 abstracts and 10 full texts were studied. At the end, 7 papers (22-28) by were recognized as eligible for including in this systematic review (**Figure.1**).
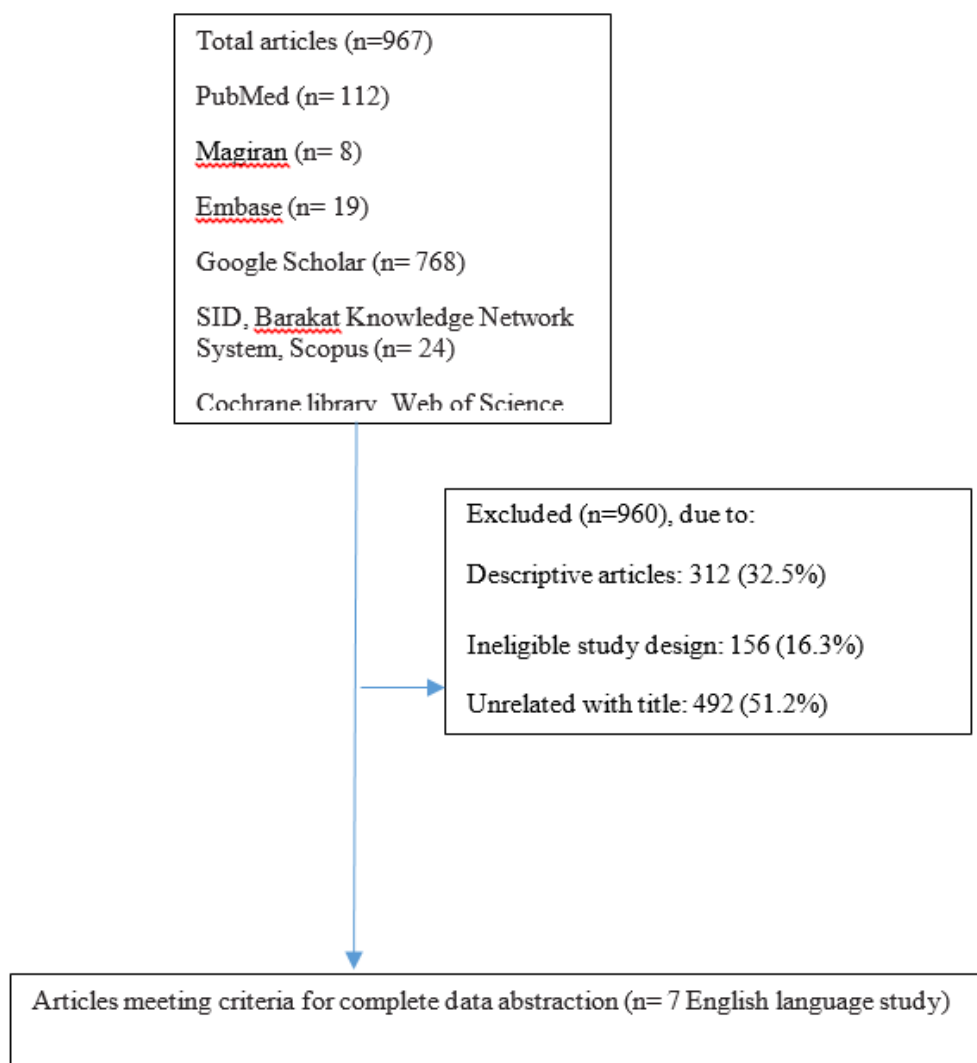
Total articles (n=967)

PubMed (n= 112)

Magiran (n= 8)

Embase (n= 19)

Google Scholar (n= 768)

SID, Barakat Knowledge Network System, Scopus (n= 24)

Cochrane library, Web of Science,

Excluded (n=960), due to:

Descriptive articles: 312 (32.5%)

Ineligible study design: 156 (16.3%)

Unrelated with title: 492 (51.2%)

Articles meeting criteria for complete data abstraction (n= 7 English language study)

Fig.1: Flowchart of study.

2-4. Risk of Bias in included studies

Two authors (TH and SG-H) independently assessed the risk of bias for each study by specified criteria in Cochran handbook (21). Any disagreements were resolved through discussion and, if necessary, through consultation with a third person (MM). Biases were considered by Cochran handbook as low risk, high risk and unclear.

2-4-1. Random Sequence Generation (Checking for Possible Selection Bias)

If the trial used unpredictable randomized process such as computer-based random numbers or tables of random numbers was reported as low risk and in case of using

nonrandomized process such as birth date, even odd numbers and file numbers, it was reported as high risk.

2-4-2. Allocation Concealment (Checking for Possible Selection Bias)

Strategy used to allocation concealment was assessed as low, high and unclear risk of bias. Trials were reported as low risk which were used packed, numbered, matte envelopes or envelopes administered centrally or phone assignment for allocation concealment. Bias was reported as high when the mentioned ways were not used or even odd numbers or alternative numbers were used.

2-4-3. Blinding of Participants, Personnel and Assessors (Checking for Possible Performance Bias)

Strategy used for blinding was considered as low, high or unclear risk of bias. Trials were reported with low risk of bias in which both the researcher and participants or evaluators were blind.

2-4-4. Incomplete Outcome Data (Checking for Possible Attrition Bias)

The strategy used for incomplete outcomes was assessed as low, high or unclear risk of bias. Exclusion of study, loss to follow-up and number of participants entered in each stage of analysis as well as the reasons of exclusion or dropping and methods used for balancing missed data, if mentioned in included trials, were reported. Trials were reported as low risk of bias which did not have any missed data or there was balance between the groups in this regard.

2-4-5. Selective Reporting (Checking for Reporting Bias)

Strategy used for reporting bias was considered as low, high and unclear risk of bias. Trials were reported as low risk of bias in which all predetermined outcomes were reported. Trials were reported as high risk in which not all predetermined outcomes were reported or if there was a primary outcome in the trial that had not been predetermined. The risk of bias for each investigated study was described based on the Consort checklist in Table1 and was showed in **Figure.2**.

2-5. Data Analysis

Seven articles were entered in this review, two authors independently extracted data and the meta-analysis was done by RevMan-version 5.3 software. In a meta-analysis (**Figure.3**), because of I^2 above 25, random effect was reported instead of fixed effect (27). Since tools used to evaluate mental health were different in included studies, so standard mean difference was reported instead of mean difference.
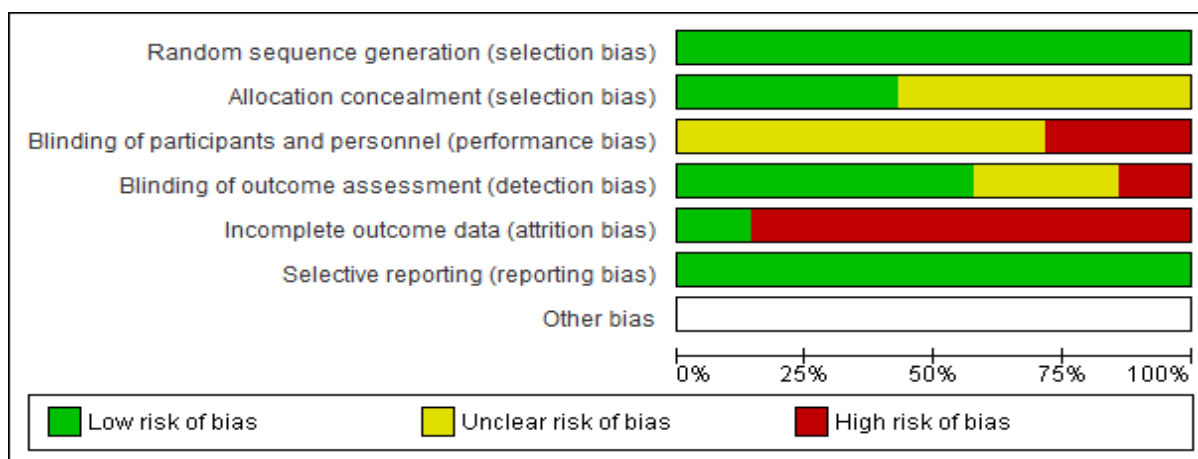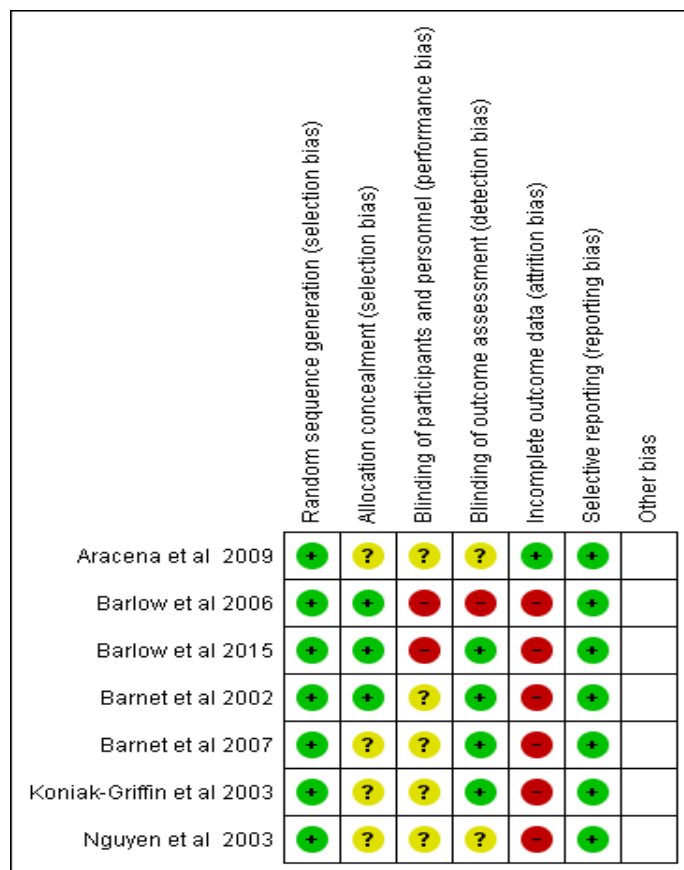
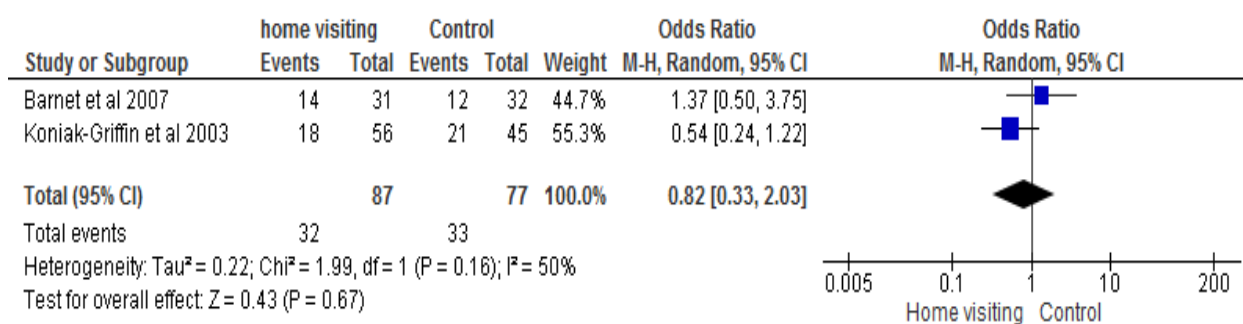**Fig.2:** Diagram of Bias in the Included Studies.

Fig.3: Meta-Analysis of Repeat pregnancy.

3- RESULTS

This systematic review aimed to determine the effect of prenatal home visiting on maternal and neonatal outcomes in adolescent mothers. According to databases search, 967 published papers were found that among them 913 papers were not recognized as related. From 54 papers with related topic, 44 abstracts and 10 full text papers were studied. There were 10 clinical trials that three of them were excluded for following reasons:

In Lee et al.'s study (2009), the participants were both adolescents and adults (19). In Mistry et al.'s study (2016), there was control group, but the results of this group hadn't been reported (22). In Samankasikorn et al.'s study (2016), there was an intervention group, but the control group had no inclusion criteria of the present review and had been supported by telephone (23). Thus, 7 studies were included in this systematic review as follow (**Table.1**):

The study of Barnet et al. (2002) was a clinical trial, done on 232 pregnant adolescents between 12 to 18 years old, gestational age of 28 weeks and more that randomly were selected. In case of the adolescents' interest to participate in the study, they were assigned into two groups of intervention and control through blocked randomization design. Home visitors were women over 21 years old, were trained 16 hours and visited pregnant adolescents in intervention group and their family and gave them required education for 90 minutes. Ordinary activities in these sessions were as follow: discussing infant development, role-playing age-appropriate discipline, engaging in age-appropriate leading or play activities and taking cultural and social outing in the community. Pregnant adolescents in both intervention and control groups received routine pregnancy cares such as health care, day care, parenting classes. In this study, Mental Health Inventory-5 (MHI-5), a short form of the RAND mental Health Inventory (The RAND, Research and Development Corporation is a nonprofit institution that helps improve policy and decision-making through research and analysis) was used to assess mental health. Scores range on this scale was between 0 to100 that higher scores indicated better mental health and score lower than 67 (cut off point) was considered to define poor mental health. The study results indicated that the mean score of mental health was 60.0 (standard deviation [SD]= 22.7) for intervention group and 64.4 (SD= 20.1) for control group. So according to the study, home visiting did not accompany with adolescent's mental health improvement (mean difference: -4.5, 95% Confidence Interval [95% CI]: -2.7 to 11.6) (28).

Koniak-Griffin et al.'s study (2003) was a clinical trial done on 101 adolescents between 14 to 19 years old, with gestational age of 26 weeks or less and first pregnancy that randomly selected. In case of the adolescents' interest to participate in the study, they assigned to one of two groups (intervention and control) by using computerized program. Control group contained 45 members who were received required educations for evaluating and consulting pregnancy cares, delivery preparation, self-care, well-baby care consisting vaccination and education planning. For intervention group which had 56 members, 17 home visiting were done during pregnancy and postpartum period (2 times during pregnancy and 15 times in postpartum period), and duration of each home visiting was 90 to 120 minutes. Presented educations in these sessions contained improving maternal health behavior during pregnancy and after it, birth outcomes and maternal and neonatal health, creating maternal skills and improving relation quality of mother and child, preventing early repeat pregnancy, increasing educational success

and creating social competence. Maternal-neonatal outcomes data was collected 6 times: just after delivery, 6 weeks later, 6, 12, 18 and 24 months after delivery. Results showed that repeat pregnancy rate during 24 months after delivery in the intervention group was 18 cases (32%), and 21 cases in the control group (47%) which was 15% more in the control group than the intervention group. Also, birth rate in 24 months after delivery was 6 cases (11%) in the intervention group, and 4 cases in the control group (9%). Results indicated that there was no significant difference between two groups regarding repeat pregnancy and birth rate (29).

Nguyen et al.'s study (2003) was done on 225 pregnant adolescents under 20 years old, their gestational age were under 28 weeks and they were primigravid. Participants were randomly assigned to one of the two groups of intervention and control. Control group had 121 members who received pregnancy routine cares and intervention group had 104 members who had home visiting once a week during first 4 weeks, then once in two weeks till delivery, then once a week for first 6 weeks after delivery, then once in two weeks till 20 months after delivery and then once a month till the infant became 24 months. Home visitors were trained for 3 weeks and home visiting sessions took 60 to 90 minutes in which required trainings on personal hygiene, environmental health, improving maternal role, maternal life course development and child and family functioning were presented. Results indicated that average maternal weight gain during pregnancy in the intervention group was 39.87 (SD= 35.00), and in the control group was 40.35 (SD= 73.89) pounds that was equal in both groups. Also, average gestational age at delivery in the intervention group was 38.88 (SD=2.23) weeks and in the control group was 38.92 (SD= 2.70) weeks that both groups were same, but more percentage of

adolescents in the control group (8.2%) compared with the intervention group (4.3%) gave birth to infants under 37 weeks. Also, average weight of infants at delivery in the intervention group was 3294.32 (SD=567.56) grams and in the control group was 3130.06 (SD= 570.78) grams that was more in the intervention group than control group (30).

Barlow et al.'s study (2006) was done on 53 pregnant adolescents between 12 to 19 years old with gestational age of 28 weeks or less that randomly selected. In case of the adolescents' interest to participate in the study, they were assigned to one of the study groups (control and intervention) by using a computerized program. Control group had 25 members who were received breastfeeding training during sessions. Intervention group had 28 members that 25 home visits were done for them from 28 week of pregnancy till 6 months after delivery. Each home visiting sessions last 90 minutes and following materials were taught: prenatal cares, labor and delivery, breastfeeding, nutrition, parenting, vaccination, home safety, well-baby care, family planning, preventing sexually transmitted diseases week and maternal goal setting for personal and family development. Home visitors were women who were trained for 500 hours and they collected data 3 times during pregnancy, 2 and 6 months after delivery. Study results indicated that average mothers' knowledge 2 months after delivery in the intervention group was 71.9 (SD= 10), and 58.1 (SD= 13) in the control group (mean difference: 14.9, Confidence Interval 95%: 7.5 to 22.4), and 6 months after delivery was 71.1 (SD= 14) in the intervention group and 57.2 (SD= 15) in the control group (mean difference: 15.3, Confidence Interval 95%: 5.9 to 24.7) that intervention group significantly had more knowledge than control group. Also, study results indicated that the mean depression score 2 months after delivery was 11.6 (SD= 10)

in the intervention group and 15.2 (SD= 8) in the control group (mean difference: -3.1, Confidence Interval 95%: 2.5 to -8.8) and 6 months after delivery was 8.4 (SD=10) in intervention group and 14.2 (SD= 11) in the control group (mean difference: -6.1, Confidence Interval 95%: 0.85 to -13.0). So according to the results of the study, home visiting did not have any effect on pregnant adolescents' mental health (31).

Barnet et al.'s study (2007) was done on 84 pregnant adolescents between 12 to 18 years old whose gestational age were 24 weeks or more. In case of the adolescents' interest to participate in the study, they randomly were assigned into two control and intervention groups. Intervention group had 44 members and control group 40 person. Home visitors who were selected for their communicational skills and the ability to communicate with adolescents and their family and also having social knowledge, and they were trained for 2 days on depression, contraceptives, drug usage and domestic violence. Home visits were started in third trimester of pregnancy and then were done once in 2 weeks till the first year after birth and then monthly till the end of second year after birth. In the first year after delivery, 8 persons (22%) in the intervention group and 6 persons (23%) in the control group were depressed and in the second year after delivery, 11 persons (36%) in the intervention group and 8 persons (25%) in the control group were depressed that there were no significant difference between groups on depression (odds ratio: 2.1; Confidence Interval 95%: 0.6 to 7.1). In this study, Center for Epidemiologic Studies- Depression (CES-D) depression questionnaire was used to evaluate maternal mental health in which numbers higher than 21 were considered as depressed. Repeat birth frequency in both intervention and control groups in the first year was 8% (3 person in the intervention group and 2 in the control group), and in

second year, 4 person (13%) in the intervention group and 6 person (19%) in the control group had repeat birth that there were no significant statistical difference between two groups (odds ratio: 0.6; 95% Confidence Interval: 0.2 to 2.6). Repeat pregnancy frequency in the first year was 7 person in the intervention group (19%) and 5 in the control group (19%) and in the second year was 14 person (45%) in the intervention group and 12 (38%) in the control group in which there was no significant statistical difference between two groups regarding repeat pregnancy (32).

Aracena et al.'s study (2009) was done on 90 primigravid adolescents between 14 to 19 years old. Home visitors were trained on subjects such as adolescence, adolescents' pregnancy, children growth, transgenerational conflicts, and couples relation, cooperation with other family members, couples partnership, discovering adolescents' interests and respect for her privacy. Control group received just pregnancy routine cares and intervention received not only pregnancy routine cares but also home visiting. Home visits were started during third trimester of pregnancy and were continued till children became one year. Averagely 12 home visits were done for each mother and each lasted one hour. To evaluate mental health, the Chilean adaption of the Goldberg's General Health questionnaire was used. According to the results, before intervention, mean score of mental health in the intervention group was 11.30 (SD= 5.56) and 12.63 (SD=5.55) in the control group. After intervention, mental health mean score in the intervention group was 10.94 (SD= 5.58) and 13.85 (SD= 6.99) in the control group. Intervention group significantly had higher level of mental health than control group (33).

Barlow et al.'s study (2015) was done on 322 pregnant adolescents between 12 to 19 years old with gestational age of 32 weeks

or less whom selected randomly. Evaluating maternal neonatal outcomes was done in two intervention and control groups in 28th and 36th pregnancy weeks and also in 2, 6, 12, 18, 24, 30, 36 months after delivery. Home visitors should have diploma and gain needed experiences at least for 2 years and have the ability of speaking local language and also English. Each home visit did not last more than one hour and contained primary conversation, training, questions, answering questions and also giving the abstract summary sheet. Home visits were done once a week in third trimester and then once in two weeks till 4 months after delivery, then once a month from 4 to 12 months after delivery and then once in two months during 12 to 36 months after delivery. According to results, there was a significant statistical difference between intervention and control groups in terms of parenting knowledge. Mean score of Knowledge in the intervention group was 15.94 and in the control group was 14.66 (mean difference: 1.28; 95% Confidence

Interval: 0.70 to 1.86), so home visiting was effective on increasing knowledge. Also, mean score of depression in the intervention group was 12.48 and in the control group was 13.65 (mean difference: -1.17, 95% Confidence Interval: -2.05 to -0.28) which was significantly less in the intervention group than the control group so home visiting was effective on decreasing depression score (p=0.01) (34).

The meta-analysis result done on 375 person indicated that mental health in the group which had home visiting was significantly better than the control group (Standard mean difference: -0.33; 95% Confidence Interval: -0.57 to -0.10; p=0.006) (**Figure.4**). Also, in this study, meta-analysis done on 185 person showed that there was no significant difference between intervention and control groups on repeat pregnancy (odds ratio: 0.82; 95% Confidence Interval: 0.33 to 2.03; p= 0.67), and repeat birth (odds ratio: 0.90; 95% Confidence Interval: 0.35 to 2.31; p= 0.82) (**Figures 3 and 5**).

Table-1: The summary of included studies and their risk of bias.

Barnet et al. 2002 (28)		
Methods	Randomized controlled trial with assignment to home visitation or control group.	
Participants	232 Adolescents aged 12 to 18 years at 28 or more week's gestation or who had delivered a baby in the past 6 months.	
Interventions	Volunteers were recruited from the community and trained to implement a parenting curriculum during weekly home visits. Each volunteer was paired with one teenager.	
Outcomes	Mental health	
Risk of bias		
Bias	**Authors' judgment**	**Support for judgment**
Random sequence generation	Low risk	Randomization was carried out using a permuted block design for consecutively presenting eligible teenagers.
Allocation concealment	Low risk	After obtaining signed informed consent, the program staff called the office, identified the new enrollee, and obtain participant's group assignment.
Blinding of participant and personnel	Unclear risk	No specific information regarding personnel blinding has been given.
Blinding of outcome assessment	Low risk	Structured interviews were conducted at baseline and at 1 months follow -up by research staff blinded to group assignment.
Incomplete outcome data	High risk	232 teen who were randomized to home visitation and control groups. Of these 94% completed a baseline interview, 63% completed a follow-up interview and 57% completed both.
Selective reporting	Low risk	Both primary and secondary outcomes has been reported.

Koniak-Griffin et al. 2003 (29)

Methods	Randomized controlled trial
Participants	101 Adolescents 14–19 years of age; 26 weeks gestation or less; having their first child; and planning to keep the infant.
Interventions	The experimental group (n =56) received preparation for motherhood classes plus intense home visitation from pregnancy through 1 year post birth; the control group (n= 45) received traditional public health nursing care.
Outcomes	Repeat pregnancy and repeat birth within 24 months

Risk of bias

Bias	Authors' judgment	Support for judgment
Random sequence generati	Low risk	After obtaining written informed consent in accordance with the university Internal Review Board requirements, adolescents were randomly assigned, using a computer-based program, into the EIP or TPHNC groups.
Allocation concealment	Unclear risk	No specific information regarding allocation concealment been given.
Blinding of participant and personnel	Unclear risk	To avoid contamination, each PHN provided individualize care on a one-to-one basis to adolescents in only one group.
Blinding of outcome assessment	low risk	All interviews were conducted by evaluator PHNs who were not involved in the intervention and were blind to group assignment.
Incomplete outcome data	High risk	There were 43 drop-outs in the study.
Selective reporting	Low risk	Both primary and secondary outcomes has been reported.

Nguyen et al. 2003 (30)

Methods	Randomized controlled trial
Participants	Two hundred twenty-five Hispanic adolescent mothers and their infants
Interventions	Participants in the control group received the traditional services; the intervention group received interventions from advanced trained public health nurses. The control group received a minimum of three home visits: one initial client assessment and family profile, one antepartum visit, and one postpartum visit, including newborn assessment. Participants in the intervention group received weekly home visits for the first 4 weeks, followed by visits every other week until delivery, weekly visits for the next 6 weeks, visits every other week until the child was 20 months, and monthly visits until the child was 24 months of age.
Outcomes	Maternal weight gain during pregnancy, Gestational age, Birth weight

Risk of bias

Bias	Authors' judgment	Support for judgment
Random sequence generation	Low risk	Participants for this pilot study were randomly assigned to the control or intervention group by the drawing of colored blocks.
Allocation concealment	Unclear risk	No specific information regarding allocation concealment been given.
Blinding of participant and personnel	Unclear risk	No specific information regarding personnel blinding has been given.
Blinding of outcome assessment	Unclear risk	No specific information regarding assessor blinding has been given.
Incomplete outcome data	High risk	Of the 225 Hispanic adolescents, 49 were lost to follow up.
Selective reporting	Low risk	Both primary and secondary outcomes has been reported.

Barlow et al. 2006 (31)

Methods	Randomized controlled trial
Participants	Fifty-three pregnant American Indian adolescents were randomly assigned to intervention (n=28) or control (n=25) groups.
Interventions	Paraprofessionals delivered 41 prenatal and infant care lessons in participants' homes from 28 weeks' gestation to 6 months postpartum.

Outcomes	Parenting Knowledge; Mental health	
Risk of bias		
Bias	**Authors' judgment**	**Support for judgment**
Random sequence generation	Low risk	Randomization stratified by site was determined by the randomization.com website prior to enrolling any study participants.
Allocation concealment	Low risk	After each participant signed consent/assent forms a completed the baseline assessment, the educators faxed the materials to the data manager in Baltimore. The data mana; checked that all assessments were properly completed, confirm that the teen met inclusion criteria and no exclusion criteria, and then informed the educator of the participant's group assignment
Blinding of participant and personnel	High risk	The participants and evaluators were not blind to interventio assignment
Blinding of outcome assessment	High risk	The study lacked blind evaluators to the intervention group Although most of the outcomes were self-reported, the educators supervised the self-report and conducted the observation skill assessment, which may have biased reported outcomes.
Incomplete outcome data	High risk	Of the 61 enrolled, 8 (13%) dropped out before randomization.
Selective reporting	Low risk	Both primary and secondary outcomes has been reported.
Barnet et al. 2007 (32)		
Methods	Randomized trial	
Participants	84 Pregnant adolescents aged 12 to 18 years, predominantly with low incomes and of African American race.	
Interventions	Home-visiting program	
Outcomes	Repeat pregnancy; Repeat birth; Mental health	
Risk of bias		
Bias	**Authors' judgment**	**Support for judgment**
Random sequence generation	Low risk	Program staff identified eligible adolescents from computer scheduling databases and approached them during a prenatal care visit and explained to them the program and study. After informed consent was obtained from adolescents and their parents or guardians, adolescents completed baseline structured interviews administered by research staff and were randomly assigned to a home-visited group or a usual care control group.
Allocation concealment	Unclear risk	No specific information regarding allocation concealment l been given.
Blinding of participant and personnel	Unclear risk	No specific information regarding personnel blinding has beer given.
Blinding of outcome assessment	Low risk	Research staff blinded to the adolescents' group assignmen conducted structured baseline interviews. The evaluation wa; separate from program activities; thus, individual-level dat; collected from research interviews (e.g. standardized depressio assessments) were not shared with program staff.
Incomplete outcome data	High risk	Eighty-four teens were randomized to receive home visits (n=44) and usual care as a control (n = 40). Among those randomized, follow-up assessments were completed at 1 year by 62 teens (74%) and at 2 years by 63 teens (75%).
Selective reporting	Low risk	Both primary and secondary outcomes has been reported.
Aracena et al. 2009 (33)		
Methods	Experimental, randomized, controlled clinical trial.	
Participants	90 young women who conceived their first child between 14 and 19 years of age.	
Interventions	It involved community participation in the implementation of the program through	

		health educators who conducted the home visits under the guidance of nurse-midwives from the local health center.
Outcomes		Mental health of the adolescent mothers

Risk of bias

Bias	**Authors' judgment**	**Support for judgment**
Random sequence generation	Low risk	The adolescents who met the criteria, and accepted to be part of the study were randomly assigned to the control and experimental groups.
Allocation concealment	Unclear risk	No specific information regarding allocation concealment has been given.
Blinding of participant and personnel	Unclear risk	No specific information regarding personnel blinding has been given.
Blinding of outcome assessment	Unclear risk	No specific information regarding assessor blinding has been given.
Incomplete outcome data	Low risk	When analyzing the 14 lost cases (missing data) no significant differences were found with respect to those adolescents who finished the intervention, in age, years of schooling and other variables measured at the beginning of the program.
Selective reporting	Low risk	Both primary and secondary outcomes has been reported.

Barlow t al. 2015 (34)

Methods		A multisite, randomized (1:1), parallel-group trial
Participants		322 American Indian teens (ages 12-19 years at conception) at no more than 32 weeks gestation
Interventions		Paraprofessional home-visiting
Outcomes		Parenting knowledge

Risk of bias

| **Bias**	**Authors' judgment**	**Support for judgment**
Random sequence generation	Low risk	The data manager created the randomization sequence by using Stata 9.0 (StataCorp, College Station, Tex., 2005). Participants were stratified by site, age (12–15 and 16–19 years), and parity (0 and $1) and randomized with a 1:1 allocation in blocks of four into two study arms: Family Spirit plus optimized standard care or optimized standard care alone.
Allocation concealment	Low risk	After enrollment, the paraprofessional family health liaiso telephoned the study coordinator to receive each participan randomization status.
Blinding of participant and personnel	High risk	Neither the liaisons, who implemented the optimized standard care condition and self-report assessments, nor the family health educators, who implemented the Family Spirit intervention, were blind to randomization status.
Blinding of outcome assessment	Low risk	Independent evaluators, who administered the Infant Toddle Social and Emotional Assessment and the HOME, were blind to randomization status.
Incomplete outcome data	High risk	Within the intervention group, 13 received no Family Spirit lessons. Two mothers (both in the control group) and four infants (intervention, N=1; control, N=3) died during the trial. Twenty-five mothers (intervention, N=18; control, N=7) withdrew during the study period. Wave-specific participation rates for postpartum assessments ranged from 92% at 6 months postpartum (N=296; intervention, N=143; control, N=153) to 83% at 36 months postpartum (N=266; intervention, N=124; control, N=142
Selective reporting	Low risk	Both primary and secondary outcomes has been reported.
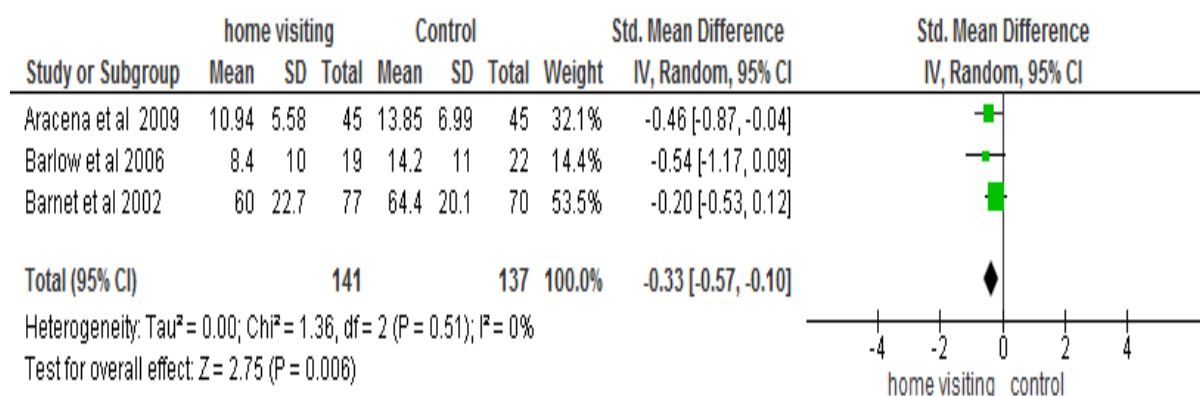
Fig.4: Meta-Analysis of Mental Health.
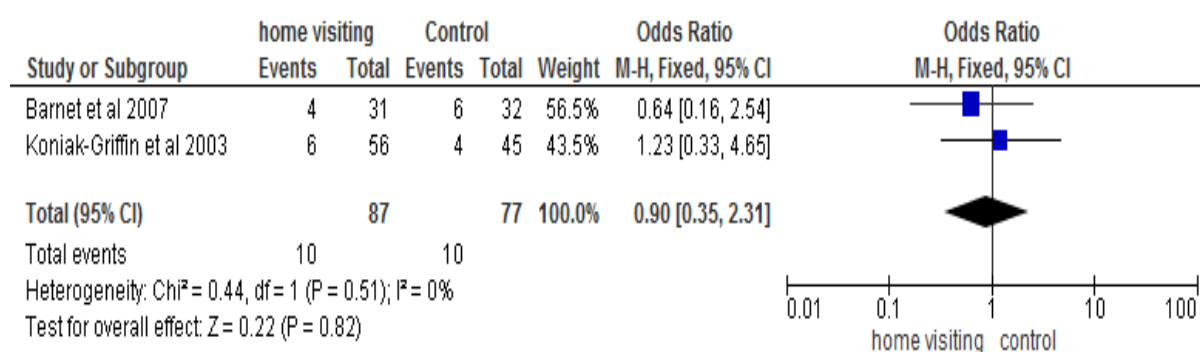
Fig.5: Meta-Analysis of Repeat Birth.

4- DISCUSSION

This systematic review investigated the effect of prenatal home visiting on maternal and neonatal outcomes in adolescent mothers. Results of meta-analysis in this systematic review showed that there was a significant difference between home visiting group and control group in terms of mental health but there was no significant difference between intervention and control groups in terms of repeat pregnancy and repeat birth. Tools used for assessing mental health in the included studies were different, so standard mean difference was reported instead of mean difference. In Barnet et al.'s study (2002) (28), MHI-5 mental health questionnaire (a short form of the RAND Mental Health Inventory) was used. Scores range in this scale is from 0 to 100 that higher scores show better mental health. In Barlow et al.'s study (2006) (31), self-made questionnaire was used which contained 20 questions with score range of 0 to 4 and score limit was from 0 to 60 and higher scores indicate a worse condition of mental health. In Barnet et al.'s study (2007) (32), Center for Epidemiologic Studies- Depression (CES-D) scale was used which consisted of 20 questions in which getting 21 score or higher indicates a moderate or severe depression. In Aracena et al.'s study (2009) (33), the Chilean adaptation of the Goldberg's General Health Questionnaire was used to evaluate mental health. Barnet et al. (2002) in a study with the aim of determining the effect of volunteer home visitation on parenting and mental health outcomes of pregnant adolescents showed that there was no significant difference between intervention and control group on

mental health. Home visitors were unprofessional people and although they gained data about adolescents' mental health issues, but they were not professionally trained to evaluate mental health, so severe depression symptoms have not been identified and were not referred for treatment (28). In fact, it's unreasonable to expect home visitors to be able to detect adolescents with depression symptoms while the specialist may not be successful in identifying it (35). In other study conducted by Barlow et al. (2006) about the effect of home-visiting intervention on child care among 53 American Indian adolescent mothers, there was no significant difference between intervention and control groups on mental health, however mean difference between two groups showed that interventions may help to decrease maternal depression symptoms. The sample size in this study was low and this could be a factor for not being statistically significant (25).

Also, in a study done by Barnet et al. (2007) regarding the effects of home visiting on parenting and maternal life course of pregnant adolescents, the results showed that there was no significant difference between two intervention and control groups in terms of mental health that may be for this reason that home visiting is not a standard tool for screening depression (26). Barnet et al. (1996) concluded that home visiting program is not an appropriate method for identifying depressed adolescent mothers (36). Tiemens et al. (1996) reported that recognition of depression without evidence-based treatment for adolescents does not improve the results (37). Study done by Aracena et al. (2009) (33) on 90 pregnant adolescents and study done by Barlow et al. (2015) (34) on 322 pregnant adolescents showed that mental health of intervention group was significantly higher than control group. The same results were obtained in the studies of Johnson et al.

(1993) and Marcenko et al. (1994) (38, 39). Also, in this study, there was no significant difference between intervention and control groups in terms of repeat pregnancy according to meta-analysis. Study done by Koniak-Griffin et al. (2003) on 101 pregnant adolescents showed that there was no significant difference between intervention and control group on repeat birth and repeat pregnancy. Although lower rate of repeat pregnancy in adolescent mothers was observed in home visiting group but there was clinically significant difference between groups because the short interval between pregnancies may have negative impact on the lives of these mothers and their children (29). In the study done by Barnet et al. (2007) on 84 pregnant adolescents, there was no significant difference between intervention and control groups in terms of repeat birth and repeat pregnancy (32). Also, in studies conducted by El-kamary et al. (2004), and Olds et al. (2004), the same results were obtained (40, 41). It seems that knowledge and access to contraceptive services alone do not decrease repeat pregnancy (42) and the contraception motivation is influenced by many factors including the desire of the spouse to have more children (43).

In two studies included in this systematic review, the effect of home visiting on parenting knowledge has been evaluated and there was a significant difference between intervention and control groups on this issue. In the study done by Barlow et al. (2006) on 53 pregnant adolescents, intervention group significantly had higher level of knowledge than control group (31). In other study by Barlow et al.'s study (2015) which was done on 322 pregnant adolescents, the results showed a statistically significant difference between intervention and control groups regarding parenting knowledge (34). Of course due to lack of statistical information, we could not do meta-analysis (SD hadn't been

mentioned in study of Barlow et al.). In this systematic review, other secondary outcomes such as gestational age, birth weight and maternal weight gain during pregnancy were not considered for meta-analysis because these outcomes had been assessed only in one study. The results of Nguyen et al.'s study (2003) on 225 pregnant adolescents showed that there was no statistically significant difference between the intervention and control groups on maternal weight gain during pregnancy.

Also, in terms of gestational age at delivery, there was no statistically significant difference between intervention and control groups, but greater percentage of adolescents in the control group than intervention group gave birth to infants under 37 weeks. Also, the birth weight in the intervention group was higher than that in the control group (30). The results of Lee et al.'s study (2009) on 501 pregnant women showed that prenatal home visitation program by focusing on social support and health education can decrease LBW (Low Birth Weight) among endangered pregnant women and adolescents that its reason is due to decreasing of preterm birth (19).

In review study of Issel et al. (2011) entitled "prenatal home visiting effectiveness for improving birth outcomes", 28 studies were included that 14 studies were RCT. From 24 studies, 5 studies (21%) reported significant positive effect on gestational age and 17 studies (41%) reported significant positive effect on birth weight. Results of this review study indicated that there is no evidence in this regard that prenatal home visiting can improve infant birth weight or gestational age (24). The results of Lchikawa et al.'s study (2015) done on 1023 pregnant women showed that home visiting can have effect on preterm birth but not Small for gestational age (SGA) (21).

5- CONCLUSION

Results of this systematic review indicates that home visiting can improve mental health but does not have any effect on repeat pregnancy and repeat birth. Also, there were no enough evidences to show the effect or not effect of home visiting on other maternal and neonatal outcomes such as parenting knowledge, gestational age at delivery, birth weight and maternal weight gain during pregnancy. Clinical trials with accurate methodology by controlling effect of number and duration of home visiting are recommended.

6- CONFLICT OF INTEREST: None.

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