The Prevalence of Alcohol, Substance and Cigarettes Exposure among Pregnant Women within a General Hospital and the Compliance to Brief Intervention for Exposure Reduction

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ABSTRACT

Background: Compliance and impact of a time-limited brief intervention (BI) for reducing exposure to alcohol, psychoactive substances and nicotine among women admitted to the hospital during pregnancy were assessed.

Methods: Pregnant women (gestational week ≤30) from a medical center pre-delivery, emergency and high-risk units were interviewed about alcohol (AUDIT and TWEAK questionnaires), smoking (modified Fagerström) and psychoactive substance (modified ASI). All exposed women were invited to participate in a BI and underwent follow-up. Characteristics and rate of exposure were compared to a "standard-group" of non-selected women who arrived to the hospital directly solely to give birth.

Results: Forty-six of the 108 study participants (42.6%) were exposed to smoking (85%), alcohol (41%), or drugs (39%), and 41 underwent the BI. Self-report of exposure was reduced significantly following BI but re-elevated post-delivery. Women belonging to the "standard-group" were better educated, had lower lifetime rates of exposure, and gave birth to newborns with higher birth weights (3254.7±506.9 g vs. 2650.8±785.6 g for the study group).

Conclusion: Compliance of the exposed women to BI was high and contributed to exposure reduction during pregnancy but relapsed following delivery.

BACKGROUND

Nicotine smoking and the use of alcohol and drugs during pregnancy are associated with a significant health risk to the developing fetus. Prenatal alcohol exposure may cause miscarriage, stillbirth, and a range of lifelong disorders, known as Fetal Alcohol Spectrum Disorders (FASD). Illicit substance use during pregnancy also places the fetus and newborn at increased obstetric risk for complications, such as abruption placenta, amnionitis, early pregnancy loss, intrauterine growth retardation, late intrauterine death, placental insufficiency, postpartum hemorrhage, preeclampsia and eclampsia, premature labor, premature rupture of membranes, and septic thrombophlebitis (1). Once fertilization is achieved, nicotine smoking is associated with an increased risk of ectopic pregnancy (RR = 1.8) (2). Women who smoke during pregnancy have an increased risk of premature rupture of membranes associated with premature delivery (<37 weeks' gestation) (3). Preterm delivery is strongly associated with an increased risk for fetal, neonatal and perinatal mortality (3-6).

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According to an estimation based on one national survey conducted in 2002 in Israel among pregnant and postpartum women (7), 13% of the pregnant women smoked cigarettes during pregnancy, lower than 18% which is the estimated prevalence among Israeli women (8) or 16% in U.S. women (9). The rate was higher among Jewish women compared to Arab women. Nicotine smoking rates were reduced during pregnancy, but not substantially (from 12.8 to 8% among Jewish women and from 3% to 1.8% among Arab women).

Drug abuse rates during pregnancy in Israel have not been reported. In the United States, it is estimated that above 4.4% of pregnant women abuse one or more substances during pregnancy (10), while 1 in 9 pregnant women continues to drink alcohol during pregnancy, and a small percentage of pregnant women continues to binge drink (11).

Alcohol consumption during pregnancy in Israel was reported in 14.1% of 3815 women in the post delivery period (12). Studies from other countries report that a strong predictor of alcohol use during pregnancy is the alcohol use level prior to pregnancy (13, 14). Upon confirmation of pregnancy, most women voluntarily reduce their alcohol use (14), however, alcohol use during pregnancy was reported to remain stable at ~12% and binge drinking was between 2-3% during pregnancy.

A brief intervention (BI) for both alcohol and nicotine smoking was found to be an important and efficient instrument to reduce alcohol and cigarette use (15-18), while screening alone was also found to be effective among pregnant women. In a study that evaluated if a voucher-based incentive is superior to "usual care" to reduce cigarette smoking and fetal growth (19), while a reduction in smoking was observed in both groups, the intervention was found to be superior. In this study, the staff did not attempt to influence smoking habits and the usual care was an inquiry regarding smoking status and a discussion regarding the advantages of smoking cessation assisted by a smoking cessation pamphlet (20).

Less information is available on the efficacy of a BI with respect to substance abuse. For pregnant drug-misusing women, compliance with treatment has been particularly problematic, even in specialized and more intensive treatment programs. One study (21) compared outcome between compliant women (participation in 4 behavioral reinforcement of drug abstinence sessions plus brief motivational therapy) to non-compliant (participated in 0-3 therapy sessions) and found higher birth weights and higher rates of drug-free women at delivery among the compliant group. Another study compared two models of motivational interviewing plus behavioral incentives for drug abstinence. Although the arm that included a case management component fared better, both intervention models were associated with poor participation (22).

Some substance abuse prevention BI techniques employ motivational counseling and are provided by non-specialists in the treatment of alcohol abuse or dependence. The main components of these interventions involve feedback of personal risk, responsibility for personal control, advice regarding behavior modification and strategies to help individuals reduce or stop drinking, an empathetic counseling style, and a declaration of confidence in the individual's ability to bring about the desired behavioral change. A BI also involves establishing a drinking goal and monitoring the progress, including ongoing support and encouragement. Several trials and reports on alcohol use indicate that both men and women benefit from BIs (14, 23). Some alcohol BI trials found women to benefit more than men (16), possibly reflecting lower initial levels of alcohol use and higher levels of motivation for behavioral changes in women. Furthermore, in the context of a therapeutic situation, women may change their behavior regarding alcohol use (stop or reduce usage) simply in response to questions about their drinking. One study from the U.S. Preventive Services Task Force (USPSTF) review (5) among childbearing-aged women (18–40 years) who screened positive for a drinking problem at study enrollment found that two 15-minute physician-delivered BI sessions resulted in a 20–25% reduction in the number of alcoholic drinks per week and binge drinking episodes that lasted for two years after the BI. Those who became pregnant had the most dramatic decreases in alcohol use (16). Interestingly, in some studies, women who were merely asked about their drinking levels consumed alcohol equally to women in the BI groups, a phenomenon already reported in other populations (24).

The official statement released by the USPSTF recommended screening and behavioral counseling interventions to reduce alcohol misuse by adults, including pregnant women, in primary care settings. For example, one BI aimed at nicotine smoking cessation among pregnant women was implemented successfully in Australia (25). Over 65% of current smokers were offered advice about the benefit of quitting, and the rate for stopping the habit was highest at month six of gestation, although women tended to relapse after the birth of their baby (25). In Israel, the preliminary results of a series of health promotion activities for nicotine smoking cessation for pregnant

women in prenatal care at four mother and child health clinics in Jerusalem pointed to a positive influence (26), but no additional reports have appeared since then.

Interventions aimed at the reduction of alcohol consumption, nicotine smoking, and substance abuse, have been reported with various degrees of success. However, an intervention directed concomitantly at exposure to alcohol, nicotine smoking and substance abuse has never been reported. We reasoned that an individual exposed to alcohol would also be at increased risk for exposure to nicotine smoking and substance abuse since it is well known that most substance abusers are also exposed to nicotine smoking. Given that each exposure can harm a newborn, we designed a BI for reducing them among pregnant women. The current study is a pilot feasibility study of concomitant BI for all harmful exposures among pregnant women who arrived at the hospital during their pregnancy. The BI was tailored to the exposures of each participant based on her responses in a structured interview. Our aims were to evaluate: 1. The rate of exposure to alcohol, nicotine smoking and substance abuse among pregnant women who were admitted to the hospital during pregnancy due to obstetric reasons, as compared to a standard pregnant women population (all pregnant women who arrive at the hospital to deliver), 2. The compliance rate to BI, 3. The effect of BI on exposure reduction at delivery and following three months post-delivery as compared to candidates who refused to participate in the BI, and 4. Newborn outcome and its relation to exposure.

METHODS

The study was approved by the local IRB committee (0292-10). Pregnant Hebrew-speaking women who were admitted to our pre-delivery unit, emergency room (ER) or high-risk unit between June 2011 and January 2012 at gestational week ≤30 were asked to participate in the study (recruitment obtained for about 5 hrs per day, in three random days, every week). All participants filled in structured questionnaires (see below), and those who reported positively for nicotine smoking, alcohol or drugs were defined as the "exposure group." If they were currently exposed or had stopped just before or during pregnancy, they were invited to participate in a BI. Participants who reported that they stopped any exposure during or just before pregnancy were asked to describe this exposure in detail. In addition, as our study group was recruited within the hospital during pregnancy, we added a control group to enable us to compare the study group's characteristics to a standard representative pregnant women population. Thus, we recruited a "standard-group" (n = 102) which consisted of all Hebrew-speaking women who arrived at the hospital to give birth during 10 consecutive days (June 4-14, 2012). Unlike the study group which was followed up during pregnancy and after delivery, the "standard-group" was studied only once, immediately following delivery, filling out the same questionnaires about pregnancy habits as did the study group.

BRIEF INTERVENTION (BI)

The BI was performed by a single academic female research assistant (AS), an experienced staff member in the addiction treatment clinic. The brief intervention was performed interactively immediately after the initial interview. If a pregnant woman responded positively to inquiries regarding current nicotine smoking, drug use or drinking, she was asked by the interviewer if she would agree to participate in a BI session. If she agreed, the interviewer proceeded to explain the dangers associated with such exposure, and their grave implications for both herself and her unborn child. The discussion was conducted in a nonthreatening atmosphere, with no blame being cast. The interviewer also provided the pregnant woman with newsletters by the Israeli National Anti Drug Authority and Israel Cancer Association which described the implications of exposure to these substances and how to avoid them (especially, during pregnancy). Furthermore, the interviewer also suggested diverse practical tips (i.e., cut cigarette into half's, use gums instead, use a plastic cigarette, or cinnamon stick) that may help with the exposure reduction, and encouraged women to find and participate in programs focusing on smoking cessation. The BI group was followed up by phone (once or twice during pregnancy, following delivery and/or three months post delivery) at which points exposure questionnaires were filled out. Due to ethical considerations, the entire "exposure group" was invited to participate in the BI. The BI was directly tailored for the pregnancy period and thus was not suggested to the "exposure group" women from the "standard-group," who were all studied following delivery.

QUESTIONNAIRES

a. The Alcohol Use Disorders Identification Test (AUDIT) is a 10-item screening tool (27) for identifying individuals with at-risk, hazardous or harmful drinking behavior. We used the AUDIT-C, which includes the

first three items of the full AUDIT that queries quantity, frequency, and a maximum level of five or more alcoholic drinks on any one occasion, and has been found to be effective in screening for alcohol misuse in women at a cut-off score of ≥3 (28, 29).

b. TWEAK is a five-item scale originally developed to screen for risk drinking during pregnancy (30). The utility of its items was demonstrated in studies of obstetric and gynecologic outpatients, and it has been validated among women in that setting (31). It includes questions on tolerance (T), worry (W), eye-openers (E), amnesia (A) and cutting-down (K).
c. Fagerström is a nicotine score that is measured with the Modified Fagerström Test for Nicotine Dependence (FTND) (32) and is comprised of six questions. The FTND yields a score of 0 (no or low) to 10 (highest severity of nicotine dependence).
d. Information on substance use is acquired by means of the modified addiction severity index (ASI) questionnaire (33). The ASI provides information about the frequency, quantity, and way of administration during the preceding month as well as lifetime use with specific adjustment to pregnancy.

DELIVERY OUTCOME VARIABLES

The pregnancy-related outcome variables were neonatal birth weight, gestational age, type of delivery, complications, APGAR 1 and 5 minute scores, referral to the intensive care unit (ICU) and duration of ICU stay, hospitalization duration, and presence of neonatal abstinence syndrome.

STATISTICAL ANALYSES

The rate and type of exposure (nicotine smoking, alcohol and psychoactive drugs) were compared between the women who were interviewed in the pre-delivery unit, emergency room (ER) or high-risk unit. Newborn outcome was compared according to the unit from which the women were discharged (i.e., not the one to which they had been originally admitted and where they were interviewed for this study). The change in exposure before BI, during pregnancy and after delivery was studied using repeated measured analyses.

RESULTS

STUDY POPULATION

Ten of the 118 women who were asked to participate declined, leaving a total of 108 (91.5%) in the study group. Their mean gestational week was 24.6 ± 6.3 (range, 5-30). Sixty-three were interviewed at the pre-delivery unit, 39 at the ER (one subsequently moved to the pre-delivery unit and 9 to the high-risk unit), and 6 at the high-risk unit. The final analyses were performed according to the place of discharge (64 from the pre-delivery unit, 15 from the high risk unit, and 29 from the ER).

The cause for admission to hospital and gestational age differed between the pre-delivery and high-risk units and the ER (Table 1). There were no differences in age, education and pregnancy outcome (newborn weight birth and gestational age).

BI GROUP: NICOTINE SMOKING, ALCOHOL AND SUBSTANCE ABUSE

Of the 108 participants, 46 (42.6%) met criteria for the "exposure" group. The rate of exposure did not differ according to the three hospital sites (Table 2). Four women had been misclassified (they were all exposed to alcohol drinking that was discontinued before pregnancy) and one woman declined, leaving a total of 41 (97.6%) women who underwent the BI. Sixty-two of the 108 study participants had never smoked, and 46 had smoked in the past or present. Specifically: 7 smoked in the past, and of the rest 39 exposed: 21 stopped during or before pregnancy and 18 were still smoking nicotine at the first evaluation.

Alcohol exposure was reported by 10 (24.4%) BI participants, and by another 4 non-BI participants. Lifetime usage of any psychoactive substance was reported by 18 (43.9%) women and it was limited to marijuana (THC) in all but one who also reported having used cocaine and LSD in the past.

Comparing the BI and non BI groups (Table 3), the BI group was less educated (48.8% vs. 66.7% had >12years of education respectively, p=0.009), with a trend for a lower rate of being married or in a relationship (85.4% vs. 95.5%, p=0.08) with no other characteristics and outcome differences.

BI GROUP FOLLOW-UP

Nicotine smoking

Nicotine smoking severity (Fagerstörm score) and the number of cigarettes were significantly reduced following the BI compared to the pre-BI results (Fagerstörm 3.7±2.0 and 2.8±2.2, F (df=1) 6.1, p = .02; cigarette number 11.0±8.1 and 4.5±6.2, F (df=1)18.7, p < .0005 (included 24 of the 39 exposed women for whom an evaluation was available for nicotine smoking during pregnancy), but elevated again after delivery (Fagerstörm 3.6±2.0

Table 1. *Comparison of characteristics between the 3 hospital discharge sites and controls*

	ER	Pre-delivery Unit	High Risk Unit	Controls	
	n (%)	n (%)	n (%)	n (%)	
	29 (100)	64 (100)	15(100)	102 (100)	p Value
Age at pregnancy (years)	31.9 ± 4.3	32.6 ± 5.4	29.1±3.2	32.7 ± 4.9	0.08
Israeli born (%)	22 (75.9)	52 (81.3)	13 (86.7)	74 (72.5)	0.5
Education ≥12years (%)	17 (58.6)	39 (60.9)	9 (60)	74 (72.5)	0.5
Employed (%) Full Part-time job No	 20 (69.0) 4 (13.8) 5 (17.2)	 48 (75.0) 4 (6.3) 12 (18.8)	 6 (40) 3 (20.0) 6 (40)	 89 (87.3) 10 (9.8) 3 (2.9)	0.001
Married or in relationship (%)	27 (93.1)	57 (89.1)	15 (100)	94 (92.2)	0.3
Gestational week (at interview) (weeks)	20.1 ± 8.8	26.6 ± 3.2	25.0 ± 6.4	-	<0.0005
Any medication (%)	4 (15.4)	12 (19.7)	3 (21.4)	18 (17.6)	0.9
Reason for admission (%) Bleeding Pain Trauma Vomit/ breath/ weakness Low movement / slow fetal growth Uterus: short/contraction /water membrane Others Elective delivery/upper limit of pregnancy due date	 5 (17.2) 6 (20.7) 2 (6.9) 7 (24.1) 4 (13.8) 2 (6.9) 3 (10.3) 0	 10 (15.6) 3 (4.7) 4 (6.3) 3 (4.7) 7 (10.9) 31 (48.4) 6 (9.4) 0	 0 (0) 3 (20.0) 1 (6.7) 1 (6.7) 2 (13.3) 4 (26.7) 4 (26.6) 0	 4 (3.9) 0 (0) 0 (0) 0 (0) 7 (6.9) 70 (68.6) 2 (2) 19 (19.6)	<0.0005
First pregnancy (%)	14 (48.3)	26 (40.6)	4 (26.7)	30 (29.4)	0.2
Pregnancy type (%) Natural IVF Other (injected, IUI)	 25 (86.2) 1 (3.4) 3 (10.3)	 50 (78.1) 8 (12.5) 6 (9.4)	 126 (80.0) 3 (20.0) 0	 94 (92.2) 5 (4.9) 3 (3)	0.1
Pregnancy follow-up (%) Hospital high-risk unit Community health services Other	 5 (17.2) 23 (79.3) 1 (3.4)	 19 (29.7) 44 (68.8) 1 (1.6)	 8 (53.3) 6 (40.0) 1 (6.7)	 13 (12.7) 89 (87.3) 0	0.001
Outcome (%) Labor Abortion Lost to follow-up	 26 (89.7) 1 (4.3) 2 (6.9)	 63 (98.4) 0 1 (1.6)	 14 (93.3) 0 1 (6.7)	 102 (100)	0.4
Successfully followed-up (%)	27(93.1)	63(98.4)	14(93.3)	-	0.4
Labor in hospital (%)	22 (81.5)	53 (84.1)	12 (85.7)	102 (100)	
Mode of delivery (%) Vaginal Cesarean Instrumental vaginal	 17 (65.4) 6 (23.1) 3 (11.5)	 31 (49.2) 31 (49.2) 1 (1.6)	 7 (50.0) 6 (42.9) 1 (7.1)	 78 (76.5) 21 (20.6) 3 (2.9)	0.003
Gestational week at delivery (weeks)	37.6±5.1	36.1±4.1	37.6±3.1	39.2±1.6	0.5
Spontaneous preterm ≤28 Preterm (28-36 weeks) >36 Unknown	1 (3.7) 4 (14.8) 22 (81.5) 2	3 (4.8) 27 (42.9) 33 (52.4) 1	0 4 (28.6) 10 (71.4) 1	0 5 (4.9) 97 (95.1)	<0.0005
Mean birth weight (gram)	2949±703	2490±810	2819±654	3255±507	<0.0005
Birth weight (%) <1500 gram 1500-2500 gram 2500-4000 gram >4000 gram	 0 (0) 8 (30.8) 18 (69.2) 0 (0)	 8 (12.7) 22 (34.9) 33 (52.4) 0 (0)	 2 (7.1) 2 (14.3) 11 (78.6) 0 (0)	 1 (1) 4 (2.9) 89 (87.3) 8 (7.8)	
Type of pregnancy (%) Singleton Twins/Triplets	 26 (96.3) 1 (3.7)	 47 (74.6) 16 (25.4)	 11 (78.6) 3 (21.4)	 99 (97.1) 3 (2.9)	0.001
Birth weight singleton (gram)	2958.7±715.4	2586.8±879.4	3035.0±418.4	3276.7±498.2	<0.0005
Apgar 1 min	8.6±0.9	7.9±2.2	9±0	8.7±1.4	0.2
Apgar 5 min	9.8±0.5	9.2±1.2	9.7±0.6	9.7±1.4	0.09
Breastfed (%)	15(55.6)	27(42.9)	7(50.0)	72(70.6)	0.004

Table 2. *Comparison of drug, alcohol and nicotine smoking exposure (during and before pregnancy) between the 3 hospital discharge sites and controls*

	ER	Pre-delivery Unit	High-risk Unit	Controls	
	n (%)	n (%)	n (%)	n (%)	
Total	29(100)	64(100)	15(100)	102(100)	p Value
Exposure group (%) No Yes – enrolled in a BI Yes - not enrolled in a BI	 14(48.3) 14(48.3) 1(3.4)	 38(59.4) 22(34.4) 4(6.3)	 10(66.7) 5(33.3) 0(0)	 76(74.5) 0(0) 26(25.5)	<0.0005
Nicotine groups (%) Current Stopped before/during pregnancy Past Never	 6(20.7) 7(24.1) 2(6.9) 14(48.3)	 9(14.1) 12(18.8) 4(6.3) 39(60.9)	 3(20.0) 2(13.3) 1(6.7) 9(60.0)	 4(3.9) 20(19.6) 15(14.7) 63(61.8)	0.1
Nicotine dependence (Fagerström score) If cigarette >0	3.3±1.9 n=13	3.5±2.1 n=22	4.8±2.4 n=5	3.2±1.9 n=21	
Cigarettes (number)	12.3±8.8	9.1±7.6	12.4±7.7	11.5±8.2	0.6
Age at nicotine smoking onset (y)	16.9±1.3	18.6±3.8	16.6±2.8	19.3±3.6	0.08
Passive exposure (spouse or partner current smoker) (%)	14(48.3)	24(37.5)	10(66.7)	30(29.4)	0.02
Drinking alcohol (%)	5(17.2)	9(14.1)	0(0)	9(8.8)	0.4
Age at onset of alcohol use (y)*	17.8±1.7	19.4±3.2	-	18.7±2.3	0.6
AUDIT score last month*	2.4±4.3	1.4±2.9	-	0.9±1.2	0.6
AUDIT score before pregnancy*	6.4±4.7	5.2±4.7	-	3.1±1.3	0.3
TWEAK score last month*	0	0.7±1.7	-	0	0.4
TWEAK score before pregnancy*	1.4±2.2	0.9±1.2	-	0.2±0.7	0.3
Lifetime use of drug (THC) (%)	6(20.6)	10(15.7)	2(13.3)	2(2)	0.001
Age at onset of any drug use (y)	20.0±3.6	18.7±3.0	16	19±4.2	0.4
Use of any drug before/during pregnancy	1(3.4)	4(6.3)	0(0)	0(0)	0.005

*Among alcohol drinking only
*Among alcohol drinking only **singleton only

and 2.6±2.1 and 3.6±2.4, time effect F(df=2)3.8, p = .01) cigarette (10.7±7.8 and 4.0±5.5 and 7.5±8.3, time effect F(df=2)1.3, p = .3) (n=22).

Alcohol

Alcohol exposure was followed up among the 10 (24.4%) BI participants. Both the TWEAK and AUDIT scores were low before the BI and during pregnancy and rose following delivery (TWEAK: before 0.2±0.5, during 0.2±0.5, following delivery 0.6±0.9; AUDIT before 0.4±0.9, during 0.4±0.9, following delivery 5.8±5.5).

Psychoactive drugs

Five women reported using THC before or during pregnancy, and none of them reported its usage during pregnancy after BI. After delivery, 2 of these 5 women reported occasional THC usage and another 2 who had lifetime usage of THC (including the one with cocaine history) reported 1-4 days in the last month of THC usage.

OUTCOME

Newborn birth weight among the women with singleton births (n = 83) was not related to nicotine smoking status, to education level or to country of birth, but it was significantly related to the location of hospital admission.

COMPARISON BETWEEN STUDY GROUP AND STANDARD-GROUP

The standard-group (a non-selected sample of women who arrived to deliver at the same hospital) (N=102) as compared to the study group (N=108) were more educated (15.4±2.6 vs. 14.6±2.8 years p=0.05 respectively). More of them were working (full time: 87.3%, vs. 68.5%, part time: 9.8% vs. 10.2% not working: 2.9% vs. 21.3%, respectively p<0.0005). More of them had a natural pregnancy (92.2% vs. 80.6%, p=0.03) and were followed up in the community health services (87.3% vs. 67.6%, p=0.001); furthermore, more of them had normal vaginal delivery (76.5% vs. 52.9%, p=0.001), a higher gestational age at delivery (39.2±1.6 vs. 36.7±4.3

Table 3. *Comparison between BI vs. non BI groups*

	BI	Non BI	
	N (%)	N (%)	
	41 (100%)	66 (100%)	P value
Age at pregnancy (years)	32.6±4.7	31.5±5.2	0.3
Israeli born (%)	31 (75.6)	55 (83.3)	0.7
Education ≥12years (%)	20 (48.8)	44 (66.7)	0.009
Married or in couple (%)	35 (85.4)	63 (95.5)	0.08
Fagerstrom score	3.5±2.1	-	
Cigarette number	10.3±8.1	-	
Age started nicotine smoking (y)	17.8±3.2	-	
Partner current nicotine smoking (%)	25 (61.0)	22 (33.3)	0.009
Drinking alcohol (%)	10 (24.4)	4 (6.1)	0.008
Age started drinking (y)*	18.9±2.9	20.5±3.0	0.4
AUDIT score last month*	1.3±2.8	3±4.8	0.4
AUDIT score before pregnancy*	5.4±3.9	6.3±6.6	0.7
TWEAK last month*	0.6±1.6	0±0	0.1
TWEAK before pregnancy*	0.3±1.7	0.5±1.0	0.03
Any drug lifetime use (THC) (%)	18 (43.9)	0	
Age started any drug use (y)	18.7±3.3	-	
Any drug during/before pregnancy	5 (12.2)	0	
Pregnancy type (%)			0.5
Natural	30 (73.2)	56 (84.8)	
IVF	4 (9.8)	8 (12.1)	
Other (injected, IUI)	7 (17.0)	2 (3.0)	
Pregnancy follow-up (%)			0.2
Hospital high-risk unit	13 (31.7)	19 (28.8)	
Community health services	28 (68.3)	44 (66.7)	
Other	0 (0)	3 (4.5)	
Mode of delivery (%)			0.3
Vaginal	23 (57.5)	32 (50.8)	
Cesarean	13 (32.5)	29 (46.0)	
Instrumental vaginal	3 (7.5)	2 (3.2)	
Gestational week at delivery (weeks)	24.1±7.0	25.0±5.9	0.5
Reason for admission (%)			0.2
Bleeding	4 (9.8)	10 (15.2)	
Pain	8 (19.5)	4 (6.1)	
Trauma	1 (2.4)	6 (9.1)	
Vomit/ breath/ weakness	5 (12.2)	6 (9.1)	
Low movement / slow fetal growth	7 (17.1)	6 (9.1)	
Uterus: short/contraction /water membrane	11 (26.8)	26 (39.4)	
Others	5 (12.2)	8 (12.1)	
First pregnancy (%)	16 (39.0)	27 (40.9)	1
Successful followed-up (%)	39 (95.1)	63 (95.5)	1
Gestational week at delivery (weeks)	36.7±4.8	36.6±4.0	0.9
Mean birth weight (gram)	2782.4±727.4	2560.2±816.4	0.7
Birth weight, n (%)			0.7
<1500 gram	3 (7.7)	6 (9.5)	
1500-2500 gram	10 (25.6)	22 (34.9)	
2500-4000 gram	25 (64.1)	35 (55.6)	
>4000 gram	1 (2.6)	0 (0)	
Type of pregnancy (%)			0.2
Singleton	35 (87.5)	48 (76.2)	
Twins/Triplets	5 (12.5)	15 (23.8)	
Mean birth weight (gram)**	2826.9±766.2	2699.8±836.9	0.2
Apgar 1 min	8.7±0.8	8.1±2	0.1
Apgar 5 min	9.5±1.1	9.5±1	1
Breastfed (%)	18 (45)	30 (47.6)	0.8

weeks, p<0.0005), a higher birth weight (3255±507 vs. 2651±786 gram, p<0.0005) and a higher Apgar 1 min score (8.7±1.4 vs. 8.2±1.8, p=0.04). In addition, more of the standard-group breastfed (70.6% vs. 47.1%, p=0.001). The standard-group was found to have a significantly lower exposure (25.5% vs. 62% respectively, p<0.0005), including smoking (current 3.9% vs. 16.7%, p=0.001), alcohol AUDIT score life (0.4±0.9 among 9 of standard-group vs. 1.7±1.5 among 14 of the study group, p=0.03) and psychoactive drug use during /before pregnancy (0 vs. 4.6%, p<0.0005). They were also less exposed to passive smoking exposure (29.4% vs. 44.4%, p=0.03).

DISCUSSION

In evaluating the rates of exposure to alcohol, nicotine smoking and substance abuse among pregnant women who were admitted to the hospital during pregnancy due to obstetric reasons, we found the most prevalent type of exposure to be nicotine smoking (36.1% of the 108 women). This rate is much higher than had been previously reported among pregnant women in Israel, as well as worldwide, i.e., ranging between 8-20% (7, 34-36). However, unlike previous studies, we recruited pregnant women within a tertiary medical center, and not within the community health care program, who by definition arrived at the hospital during pregnancy due to diverse medical conditions or complications, and should probably be regarded as a selected subgroup that differs from a general population of pregnant women.

This finding is novel, and may suggest that pregnant women whose pregnancy is at risk due to any medical reason are at an increased risk for exposure to nicotine smoking, alcohol and/or psychoactive drugs, a characteristic that most likely further (or causally) increases their risk. On the other hand it could be speculated that their medical risk is due to substance exposure. While this may be partially true, the reasons for being admitted to a hospital during pregnancy (i.e., bleeding, pain, trauma, vomiting, respiratory problems, weakness, low movement /slow growth), and women's medical problems (i.e., cardiac, metabolic, endocrine, oncologic, pulmonary, neurologic, gastrointestinal, urologic, gynecologic, hematologic, psychiatric), are not attributed directly or specifically to nicotine smoking, alcohol, and/or psychoactive drug exposure.

Specifically our study group presented with a higher exposure rate to nicotine smoking, alcohol and/or psychoactive drugs (42.6%) compared to 25.5% among our standard norm group, a non-selected sample of women who arrived to deliver at the same hospital. In addition to their own higher rate of nicotine smoking, the study group was also more exposed to passive nicotine exposure due to a higher proportion of husband/partner smoking compared to the standard-group (44.4% vs. 29.4% respectively). Nicotine smoking is well established as one of the main causes of higher mortality in low socioeconomic classes (37). Furthermore, smoking during pregnancy was reported to be related to a lower education level (38). Indeed our study group was less educated than the standard control group. Lower education may also be related to the lower rate of employment in the study group versus the standard group. However, this could be temporary and associated with their pregnancy-related medical condition. Fewer years of education may also be related to poorer health habits and lifestyles that might have contributed to the pregnancy complications that led them to seek medical care in a hospital setting during pregnancy unlike the reference group who came to the hospital solely to deliver. This possibility was not studied in the current work.

Our findings regarding alcohol consumption rates during pregnancy are similar to those previously reported in Israel (12) and in the U.S.A. (14). It has previously been reported (11, 14) that most women voluntarily reduce their alcohol use when they become pregnant. However, one of the problems with drinking is that even a low level of exposure (that may be consumed before becoming aware of being pregnant) is a risk to develop FASD, a disorder that is most likely under-diagnosed in Israel (39).

One-quarter of the women in our study group underwent an assisted pregnancy (12 IVF, 9 IUIs). Our observation that half of these women were also exposed to nicotine smoking/ alcohol/ psychoactive drugs during pregnancy (1/3 of those who did IVF) was unexpected. This contradicts finding from Finland that compared singleton births after IVF (n = 5,647) and non-IVF pregnancies (n = 285,357) and found similar rates of exposure in women who became pregnant via IVF compared to women with non-IVF pregnancies (36).

The novelty of our BI protocol is that we tailored it to accommodate all types of exposure, namely nicotine smoking and alcohol drinking and psychoactive drugs, unlike other studies on BI that reported on interventions for only one of these exposures. Our rationale was to give all exposed women the opportunity to benefit from the intervention. In addition, we had no data about the prevalence of the diverse exposures among pregnant women within a hospital setting.

The compliance rate in the present study was very high (91.5% for participation in the study) and even higher (97.6%) for participating in the BI. Notably, women who agreed to participate in the BI, also responded positively at follows up. At follow up, some of the participating women reported on initiating or participating in diverse available programs for exposure cessation (i.e., smoking). They mentioned that the motivation to initiate diverse programs was due to the BI and newsletters that they got.

We believe that these findings imply that exposed pregnant women need and want support, and would cooperate to achieve a healthy pregnancy and a healthy newborn. As a results of our positive finding of a decrease in nicotine consumption in the BI group during pregnancy, we highly recommend the implementation of a BI program during pregnancy. If this is too time consuming or not available in some settings, a screening evaluation would also seem to contribute as well. Moreover, based on our finding and consistent with other reports (25, 40) regarding the resumption or increase in smoking (severity, cigarette number) after delivery, we would suggest additional BI or screening following delivery.

As with nicotine smoking, the same pattern was observed for alcohol and psychoactive drugs, but since the rates and level of exposure were very low in our sample, it was not possible for these changes to reach a level of statistical significance. It is possible that with respect to psychoactive drugs, because they are illegal, women may not report their use, and thus their consumption may be underestimated by us.

The outcome (i.e., birth weight) of our study group was not related to BI, to nicotine smoking status, to education level or to country of birth, but it was significantly related to the location of hospital admission. This could be expected since the reasons for presenting to the three facilities had different characteristics that were found to be related to newborn weight. Those factors: bleeding (associated with lower birth weight); assisted pregnancy (i.e., in vitro fertilization); pregnancy at high-risk. Only if thousands of cases are studied would it possible to find outcome differences: i.e., the Cochrane database 2009 (18) found that smoking cessation interventions reduced rate of low birth weight (RR 0.83, 95% CI 0.73 to 0.95) and preterm birth (RR 0.86, 95% CI 0.74 to 0.98), and there was a 53.91g (95% CI 10.44 g to 95.38 g) increase in mean birth weight.

We did find outcome differences between our study group and the standard norm group (e.g., lower weight birth; 3255±507 g vs. 2651±786 g, respectively), but this is expected based on the substantial characteristics and exposure differences between them.

LIMITATIONS

Because our study included only Hebrew-speaking women and not new immigrants, the rates of the three types of exposure may have been underestimated. The fact that the study was based on self-reported questionnaires is also a drawback in terms of factual accuracy, although the reported relapse after delivery suggests that women's reports did reflect actual cigarette use. Furthermore, as the protocol did not include a reward or a punishment for nicotine smoking, there is no apparent reason for them not to tell the truth. This is supported by the Cochrane review (17) that found a similar rate of reduction in nicotine smoking in studies using either women's self reports or objective measures for the nicotine reduction.

Finally, our evaluation of newborn outcome measures and their relation to exposure and BI was affected by the low level of exposure to psychoactive drugs and alcohol, while on the other hand, there were many other variables that did have a strong effect on their outcome. It can be assumed that the lack of direct association between a BI and newborn outcomes could be related to our small sample size, because nicotine smoking, which is a known risk factor for low weight birth, was also not found to be related to weight birth in either our study or standard-group. The fact that the BI was performed in a late stage of the pregnancy is also a limitation that most likely reduced its contribution.

CONCLUSION

The overall rate of exposure to nicotine smoking, alcohol and substance abuse among pregnant women who are admitted to a hospital during their pregnancy was found to be very high. Women undergoing a BI to reduce substance abuse were highly compliant, and according to women's self-reports this intervention contributed to significant exposure reduction during pregnancy. As this reduction was lost after delivery, it is highly recommended to implement such a program during pregnancy and following delivery.

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