

Adherence to no-cost oral contraceptives among active-duty servicewomen

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ABSTRACT

Background We aimed to evaluate the adherence to no-cost oral contraceptives (OC) among young single women and to identify factors associated with non-adherence. **Methods** Retrospective cohort study included all single female soldiers who received free-of-charge OCs from military pharmacies in Israel between 2006 and 2015. Military pharmacies' dispensing registries were queried to assess the number of OC packages dispensed. Women were included in the study if their service continued for a period of at least 12 months from the time of receiving their first OC pack. Study outcomes were twelve cycles medication possession ratio (MPR), which is defined as the number of OC packs dispensed over a 12-cycle period divided by 12, presented as a percentage, and factors associated with the OC MPR as evaluated by multivariable regression analysis.

Results During the study period, there were 305 923 active servicewomen aged 18–24 years. A total of 82 203 (26.9%) women were dispensed at least one pack of OCs. The mean MPR was 51.8% (35.2%). Only 14% of women had good adherence (MPR ≥90%). Multivariate regression models showed that non-adherence (MPR <90%) was more common among servicewomen (adjusted OR (95% CI): who failed to graduate from high school (1.9 (1.54–2.33)) and with combat or combat-support type of service (1.66 (1.30–2.13)). Other social/ethnic factors, including first-generation immigrant (1.13 (1.05–1.21)), sub-Saharan African origin (1.28 (1.04–1.58)), lower IQ scores (1.28 (1.22–1.34)) and combat-support type of service (1.22 (1.12–1.34)) were associated with non-adherence, but to smaller degrees. Neither income nor health status predicted adherence in this population receiving no-cost OCs.

Conclusions Overall, 12 cycles OC adherence was universally low among active servicewomen. Adherence demonstrated small, but significant, associations with sociodemographic factors, with

Key messages

- Good adherence to no-cost oral contraception among Israeli army servicewomen is low.
- Non-adherence to oral contraceptives is more common in servicewomen who have not graduated from high school and are serving in combat type of service. There was significant, but small, variation by immigration and national origin.
- Given the universally low adherence observed, policymakers should consider making long-acting reversible contraceptive methods more accessible to all servicewomen.

the lowest levels of adherence predicted by low educational attainment and combat service.

INTRODUCTION

Oral contraceptives (OCs) are the most commonly used contraceptive method among women aged 15 to 24 years.^{1 2} In the US, over half of pregnancies among women under the age of 25 years are unintended.³ In most cases, unintended pregnancies are related to OC failure, misuse or discontinuation.^{4–7}

There is no uniform nomenclature for the measurement of adherence to medication and several terms are commonly used inconsistently, including adherence, continuation, compliance, refills and proportion of days covered.⁸ However, recent large studies showed that pharmacy claims data is a reliable tool for measuring women's adherence to OC,⁹ and a medical possession ratio (MPR) of 90% was set as a cut-off for considering adherence and non-adherence.¹⁰ The reported adherence varies among studies, both in military and non-military settings. A large prospective

study (CHOICE) reported rates of 59% and 41% for continuation of OC use at 12 and 24 months, respectively.¹¹ Younger age was associated with higher risk of OC discontinuation at 24 months, and only one-third of women aged 14–19 years were still using OCs at 24 months.¹¹ In a study of a US military population, low adherence was associated with the 18–24 years age group, lower socioeconomic status, and new start populations.¹⁰

Between 1997 and 2003, unintended pregnancies rates rose among women serving in the Israeli army, increasing from 1.86% to 2.15%.¹² In an effort to reduce rates of unintended pregnancy, the Israeli army initiated education programmes and improved access to clinical contraceptive services (Rottenstreich M, personal communication, 2018). Since 2004, the Israeli army offers OCs free of charge to enlisted women on prescription by a military physician, which are dispensed from military pharmacies. Condoms, vaginal rings, injectables (ie, Depo-Provera), subdermal implants and intrauterine contraceptives are less readily obtained and are not free of charge. Women who prefer to use other methods of contraception, rather than OCs, can obtain them outside the army's pharmacies without the national health insurance discount; in the case of intrauterine devices they may also need to pay for insertion by a private gynaecologist.

The aim of this study was to calculate the mean 12-cycle OC MPR at the first 12-month period after initiation and to evaluate factors that are associated with low MPR of free-of-charge OCs among young, single women serving in the Israeli military, in order to guide future efforts to improve adherence and to assess the need to include provision of long-acting reversible contraceptive (LARC) methods among at-risk populations.

METHODS

This was a retrospective study of all women aged 18–24 years, performing compulsory military service between 2006 and 2015, who were prescribed OCs and served for at least 12 (28-day) cycles after receiving at least one OC package. Women who were discharged less than 12 months after filling their first OC prescription were excluded from this study.

In Israel, at the age of 16 to 17 years, all prospective recruits undergo a medical examination and interview at the local Israeli Army Draft Board, which includes a psychiatric evaluation and psychometric examination, in order to assess their eligibility for military service and to assist in military assignment. At age 18 years, most healthy Israeli women from non-Orthodox Jewish families begin 2-year mandatory military service. Enlistment may be deferred for several years on request, for the completion of university studies. Women are not drafted if they are married, pregnant or diagnosed with a serious chronic illness. Women who marry during compulsory service or

conceive and desire to carry a pregnancy to term may elect to be discharged from the army. Drafted servicewomen are assigned to units and to their role in those units based on various factors, which may include: medical status (score), educational status, IQ score, presence of mental illness, and socioeconomic status. Regardless of unit assignments and role, throughout the study period, gynaecological clinic visits and OCs were provided free of charge to all women per prescription from the military physician. According to military policy, combined OCs are the drug of choice for servicewomen. Women with medical conditions that have contraindications to combined OC use¹³ are prescribed progestogen-only OCs at no cost. All free-of-charge OCs are dispensed in 28-day packages by the military pharmacies located in every permanent and deployment military camps. Soldiers may access any military pharmacy for OC refills regardless of their original prescribing pharmacy. OCs are dispensed in 28-day packages; the servicewomen may choose to obtain one to three packages each time.

Following approval by the Israel Defense Forces' (IDF) Institutional Review Board (No. 1571–2015, dated 29/07/2015), we linked data from the military pharmacies management database to data from the Army Draft Board.

The military pharmacy database was queried for a list of all women who received at least one OC package during the study period. This was cross-referenced with the women's sociodemographic record in the Draft Board database. The first cycle of OC supply was identified for each woman and the consecutive 11 cycles of OC prescription fulfilment was calculated. The MPR⁸ was defined as the number of OC packs dispensed over a 12-cycle period divided by 12 and expressed as a percentage.

Factors extracted from the Draft Board database were evaluated for association with OC adherence including paternal country of origin, immigration status, education level, IQ score, neighbourhood socioeconomic status, type of service, medical score, and any history of mental illness. The description of these variables is detailed in our previous publications,^{14 15} and is outlined briefly in this article. Several factors that were included are not intuitive; however, we hypothesised that cultural differences may play a role in adherence, and as such we included those in the analysis.

Country of origin (classified by the father's country of birth or if the father was born in Israel, by the paternal grandfather's country of birth) was categorised into seven geographical areas: (1) Asia, (2) North Africa, (3) sub-Saharan Africa (excluding South Africa), (4) Western (Europe, USA, Canada, Australia and South Africa), (5) former Soviet Union countries, (6) Israel and (7) other (ie, South America). Immigration status was categorised as first generation or longer-term resident. Neighbourhood socioeconomic status is based on an index developed by the Israel Central Bureau

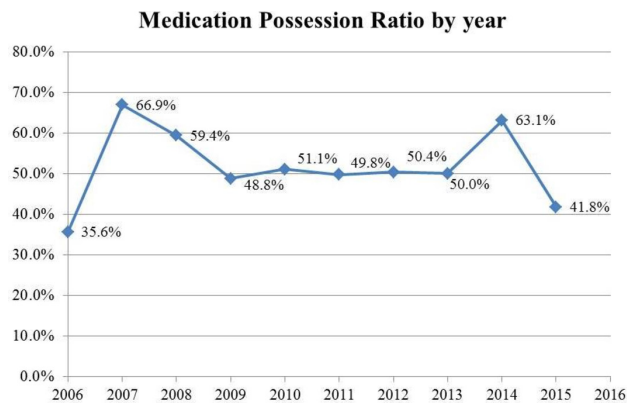


Figure 1 Medication possession ratio (MPR) by year.

of Statistics and validated previously. Briefly, Israel is divided into homogeneous 'geographical units' and each area receives an ordinal ranking from 1 to 10 (low to high socioeconomic status, respectively).¹⁶ Medical status was categorised according to the Israeli army medical protocol, as 'low' when an illness necessitating pharmacological treatment was present with or without functional impairment, 'stable' when a stable medical condition not requiring treatment was present, and 'healthy' when no illness was present. History of mental illness was determined using Draft Board data, which was coded according to International Classification of Diseases (ICD-10) criteria¹⁷ for personality disorders, affective disorders, anxiety disorders, and so on.

For the purpose of the study, MPR was coded as a categorical variable: adherent (MPR \geq 90%) and non-adherent (MPR <90%), which represent the possession of 11–12 OC packages per year and 1–10 OC packages per year, respectively.¹⁰ The adherent and non-adherent groups were compared regarding the factors extracted from the Draft Board database.

Categorical data were analysed using Chi-square or Fisher exact tests (when 20% of the cells had less than five expected cases) and continuous factors were analysed using the unpaired Student's *t*-tests as appropriate. A multivariable logistic regression analysis was performed controlling for the factors that were associated with low adherence rate in the bivariate analysis to estimate predictors of low adherence, expressed as adjusted ORs. A 95% CI and a *p* value <0.05 were considered statistically significant. All statistical analyses used SPSS 23.0 (IBM, Armonk, NY).

Patient and public involvement

As this article presents an analysis of retrospective anonymised electronic soldiers' records from the military pharmacies management database and from the Army Draft Board, the women were not involved in the design, recruitment or implementation of the study.

RESULTS

Of the 305 923 single women drafted by the Israel Defense Forces between 2006 and 2015, 82 203 (26.9%) met the study inclusion criteria and were available for analysis. More than 97% of the study population were high school graduates and most women served in non-combat roles. The mean (SD) age at enlistment was 18.7 (0.5) years; mean IQ score was 105.7 (10.5). The mean MPR was 51.8% (35.2%), the median was 41.7% (16.7–83.3) and 8615 (10.5%) women continued to use OC for 12 months after initiation. Mean MPR varied during the study period: it was the lowest in 2005 (35.6%) and reached its peak in 2006 (66.9%) though remaining mostly stable at about 50% (figure 1).

Only 11 508 (14%) of servicewomen had good adherence (MPR \geq 90). Comparing women with non-adherence to women with good adherence revealed several differences in baseline demographics and characteristics (table 1). Age at initiation of first OC (mean (SD)) was similar between the groups (19.2 (0.6) vs 19.2 (0.5) years, *p*=0.306). Non-adherent women had clinically similar (but statistically different) body mass index (BMI) than adherent women (21.2 (3.6) vs 21.0 (3.5) kg/m²), were less likely to be high school graduates, had lower IQ scores (105.5 vs 106.7), had higher medical scores, and were less likely to live in medium socioeconomic status neighbourhoods (*p*<0.001 for all).

Multivariate regression analysis, adjusted for the minimal model variables and the significant factors in the bivariate analysis, showed that several independent variables were less likely to be adherent (adjusted OR (95% CI)): failure to graduate from high school prior to joining the military (1.9 (1.54–2.33)), combat type or service (1.66 (1.30–2.13)), sub-Saharan African origin (1.28 (1.04–1.58)), having lower IQ scores (1.28 (1.22–1.34)), combat-support type or service (1.22 (1.12–1.34)), and first-generation immigrant status (1.13 (1.05–1.21)). We also found that several independent variables were more likely to be adherent: academic education after high school prior to joining the military (0.62 (0.48–0.79)), Asian origin (0.82 (0.76–0.89)), former Soviet Union country of origin (0.88 (0.80–0.96)), Western origin (0.91 (0.84–0.99)), and having high IQ scores (0.90 (0.83–0.96)) (table 2).

DISCUSSION

This study found that the 12 cycles OC MPR among single women serving in the Israeli military using OC was universally low. Furthermore we found that the factors associated with non-adherence were failure to complete 12 years of education, combat type of service and sub-Saharan African origin. Of note, women with less than 12 years of education, with combat type of service or of sub-Saharan origin each compromised less than 2% of the entire population. There were statistically significant, small, variation by immigration,

Table 1 Women's demographics and characteristics according to adherence of oral contraceptives

Demographic/characteristic	Oral contraceptives medication possession ratio (MPR)*			P value
	Non-adherent (<90%) (n=70 742 (86%))	Adherent (≥90%) (n=11 517 (14%))	All (n=82 259)	
Age at initiation of first OC	19.2±0.6	19.2±0.5	19.2±0.6	0.306
Body mass index (kg/m ²)	21.2±3.6	21.0±3.5	21.2±3.6	<0.001
Paternal country of origin				<0.001
Israel	8709 (12.3%)	1131 (9.8%)	9840 (12.0%)	
Western	15840 (22.4%)	2687 (23.3%)	18527 (22.6%)	
Sub-Saharan Africa	1185 (1.7%)	129 (1.1%)	1314 (1.6%)	
Asia	13 126 (18.6%)	2446 (21.2%)	15 572 (19.0%)	
Former Soviet Union	14829 (21.0%)	2441 (21.2%)	17 270 (21.0%)	
North Africa	16 565 (23.5%)	2622 (22.8%)	19 187 (23.4%)	
Other	328 (0.5%)	55 (0.5%)	383 (0.5%)	
Immigration status				0.15
First-generation immigrant	12 432 (17.6%)	1917 (16.6%)	14 349 (17.4%)	
Education				<0.001
Less than high school	1310 (1.9%)	112 (1.0%)	1422 (1.7%)	
High school graduate	69 061 (97.6%)	11 306 (98.1%)	80 367 (97.7%)	
Higher education	371 (0.5%)	99 (0.9%)	470 (0.6%)	
IQ score				<0.001
Low (90–99)	22 934 (32.4%)	3 156 (27.4%)	26 090 (31.7%)	
Medium (100–117)	41 482 (58.7%)	7 144 (62.0%)	48 626 (59.1%)	
High (≥118)	6 304 (8.9%)	1 217 (10.6%)	7 521 (9.1%)	
Neighbourhood socioeconomic status				<0.001
Low (1–4)	14 431 (20.4%)	2 223 (19.3%)	16 654 (20.5%)	
Medium (5–7)	39 474 (55.8%)	6 680 (58.0%)	46 154 (55.8%)	
High (8–10)	16 837 (23.8%)	2 614 (22.7%)	19 451 (23.7%)	
Type of service				<0.001
Combat	1 013 (1.4%)	82 (0.7%)	1 095 (1.3%)	
Combat-support	7 437 (10.5%)	836 (7.3%)	8 273 (10.1%)	
Non-combat	32 292 (88.1%)	10 599 (92.0%)	42 891 (88.6%)	
Medical score				<0.001
Low	18 705 (26.5%)	3 410 (29.7%)	22 115 (26.9%)	
Stable	12 783 (18.1%)	1 952 (17.0%)	14 735 (18.0%)	
Healthy	39 088 (55.4%)	6 136 (53.3%)	45 224 (55.1%)	
History of mental illness	853 (1.2%)	129 (1.1%)	982 (1.2%)	0.458

*The oral contraceptive medication possession ratio (MPR) was divided into two groups: non-adherent (MPR <90%) and adherent (MPR ≥90%), which represent the possession of 1–10 OC packages and 11–12 OC packages, respectively.
OC, oral contraceptive.

national origin and IQ; each could be related to the large sample size.

Previously, two small questionnaire-based studies of US Army servicewomen reported that roughly 40% used OC with an adherence rate of 40%.^{18 19} A large study (n=83 181) that used data from the US Military Health System Management Analysis and Reporting Tool reported that overall OC use was 34% among servicewomen aged 18–39 years, and OC use increased

with age.²⁰ Of note, none of these studies assessed risk factors for non-adherence of OC.

In the general population, a wide range of adherence rates have been reported. In a prospective observational cohort study of adolescents and women within the St Louis region (CHOICE Project) who had access to no-cost contraception, the continuation rate at 12 months was 59%.¹¹ In a study that assessed adherence to OC (defined as MPR ≥0.9) of US Army veterans

Table 2 Adjusted ORs for non-adherent versus adherent to oral contraceptives

Demographic/characteristic	Adjusted OR (95% CI)*
Paternal country of origin	
Israel	Reference
Western	0.91 (0.84 to 0.99)
Sub-Saharan Africa	1.28 (1.04 to 1.58)
Asia	0.82 (0.76 to 0.89)
Former Soviet Union	0.88 (0.80 to 0.96)
North Africa	0.96 (0.88 to 1.04)
Other	0.88 (0.64 to 1.21)
Immigration status	
First generation	1.13 (1.05 to 1.21)
Longer-term resident	Reference
Education	
Less than high school	1.90 (1.54 to 2.33)
High school graduate	Reference
Higher education	0.62 (0.48 to 0.79)
IQ score	
Low (90–99)	1.28 (1.22 to 1.34)
Medium (100–117)	Reference
High (≥118)	0.90 (0.83 to 0.96)
Neighbourhood socioeconomic status	
Low (1–4)	1.04 (0.99 to 1.10)
Medium (5–7)	Reference
High (8–10)	1.05 (0.99 to 1.11)
Type of service	
Combat	1.66 (1.30 to 2.13)
Combat-support	1.22 (1.12 to 1.34)
Non-combat	Reference
Medical score	
Low	0.97 (0.93 to 1.02)
Stable	1.00 (0.94 to 1.06)
Healthy	Reference

*Adjusted for: age at starting use, year of use, body mass index, paternal country of origin, immigration status, education, IQ score, neighbourhood socioeconomic status, type of service, medical score, and history of mental illness. Bold type denotes statistically significant data.

at 12 months, the reported rate was 39.4%.¹⁰ A small randomised controlled trial found that the continuation rates of common forms of contraception in the US are reported to be as low as 29% at 6 months.²¹ The range of adherence in our study concurs with previous publications in this regard.

Several terms are commonly used to describe adherence to medication including compliance, continuation, refills, proportion of days covered and MPR. Each method for assessing adherence has its own advantages and disadvantages, hence the most accurate way to assess OC adherence has not been defined, and

the estimation of adherence by MPR is an accepted method in closed pharmacy systems.^{22 23} The main limitation of MPR is that it is based on packages dispensed and not on the actual daily reporting of pill uptake, yet it appears to be a valid method.

Our study demonstrated that MPR rates of OC are lower among soldiers who are first-generation immigrants or did not graduate from high school prior to joining the military. These findings are supported by other recent studies, which identified strong associations between adherence rate and educational achievement in the general population.^{24 25} Failure to complete high school and being a first-generation immigrant are also known as strong risk factors for unintended pregnancies, both among the general population and military personnel.^{14 26}

This study is among the first to examine the relationship between IQ scores and MPR of OC. We showed that low IQ score is independently associated with non-adherence in our cohort. The association between IQ scores and unintended pregnancy was previously assessed by our group and was not found to be associated with unintended pregnancy in multivariate analysis.¹⁴ Our findings might reflect the impact of cognitive ability on patient grasp of the importance of adherence,²⁷ as was noted in a study that assessed the correlation between verbal intelligence and adherence to aspirin of an adult population and showed that higher IQ scores were associated with better adherence.²⁸

Large number of unintended pregnancies in the US are believed to result from OC method-related failure, misuse or discontinuation.⁴⁻⁶ Unintended pregnancies may impact army readiness and pose significant health burdens, including higher risks of abortions and adverse maternal and neonatal outcomes.^{3 29} As such, when there is an increased risk for low adherence to OC use, other contraceptive methods should be sought. Only recently, the rate of LARC among active-duty US army servicewomen was reported to be 14.5% and the overall rate of LARC insertion increased slightly over the years.³⁰ The Contraceptive CHOICE Project demonstrated an 86.7% continuation rate with LARC vs. 57.1% continuation rate with non-LARC, at 12 months.

Our study has strengths and limitations. The strengths of this study include the large cohort studied, the prospective, systematic and reliable nature of the data used, and the option to obtain IQ scores from previously validated military assessment tests.³¹ It is possible that the large number of women included also may be observed as a limitation as some differences which are not clinically significant are observed as statically significant (ie, BMI); however, most of these statistical differences are also clinically significant. Other limitations of our study are that information about the reasons for OC non-adherence is missing. A possible reason for stopping OC could be

related to sex relationships which also labelling in the analysis as ‘non-adherent’ and wasn’t excluded; however, ‘non-adherence’ as opposed to ‘compliance’ including also a voluntarily discontinuation of OC.¹⁰ Another limitation includes a possible selection bias among women included in the study, as only 27% of the entire population were prescribed OC and served for at least another year, as a result a woman who conceived during this time period and was discharged from military service was not included. However, based on previous work we have calculated that the rate of unintended pregnancies in the Israeli army is 1.8% and 27% of those women are discharged.³² We lack the information to differentiate between intentional discontinuation and erratic filling. We also lack information regarding the medical indication for OC use, even though previous studies have shown that among this age group the majority are prescribed OC for contraception as opposed to other indications.³³ In other studies^{11 24} also, adherence of OC was assessed but the indication for OC prescription was not mentioned. We assessed adherence rate by calculating the number of packages dispensed from army pharmacies; this may not reflect true use as prescriptions might be collected but not used, or filled elsewhere. The latter seems less likely, as only at army pharmacies would the prescription be filled for free. In private pharmacies one OC package costs about 10% of a soldier’s monthly salary. Like all retrospective studies, the current study relied on data currently available for analysis; it is possible that other factors that were not explored may have much greater impact on OC adherence in this population, for example, previous OC use and sexual activity.

In conclusion, low OC adherence rate was seen in nearly all servicewomen in their first year of OC initiation, similar to the reported adherence rate to OC in this age group. Non-adherence was associated with African origin, first-generation immigrant status, lower education level, lower IQ scores as well as combat or combat-support type of service. This information may serve to identify populations at high risk for unintended pregnancies and thus may encourage policymakers to offer, at least to this population, LARC methods. Even more so, due to the relatively low OC MPR encountered among all servicewomen, we encourage policymakers to consider no-cost provision of LARC methods to all servicewomen who want them, and to consider allowing free-of-charge personal choice of contraception method.

Contributors MR and HYS made substantial contributions to conception and design and analysis and interpretation of data, were involved in drafting the manuscript and revising it critically for important intellectual content LD, OR, RK and AR made substantial contributions to analysis and interpretation of data and were involved in writing the manuscript. All authors gave final approval of the version to be published.

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