Patterns of Drug Use among the Community-Dwelling Old-Old Population in Israel

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Abstract

Background: Due to multiple chronic illness and disability, the elderly consume a disproportionately large share of medications.

Objectives: To assess the patterns and determinants of drug use among the community dwelling old-old population.

Methods: The study population included 1,369 old-old persons from the baseline data of the Cross-Sectional and Longitudinal Aging Study (CALAS), which is based on a national random stratified sample of the Israeli Jewish population aged 75–94 years.

Results: The mean number of drugs used by the study population was 3.3, and only 12.5% did not consume any drugs. Multivariate linear regression analysis showed that women used significantly more drugs than men, and that those born in Europe took significantly more drugs than those born in Israel and Asia-Africa. The number of medical conditions was the strongest predictor of drug use. Hospitalizations during the last year and frequent visits to family physician were also significant factors related to drug use. All variables combined explained 40% of the variance in drug use by the old-old. The most commonly used therapeutic groups were cardiovascular drugs (53%), psychotropic drugs (31%), analgesics (30%), and gastrointestinal drugs (28%).

Conclusions: Our data indicate that in addition to the association of drug use with health status and healthcare utilization, the number and type of drugs taken vary with gender and place of birth.

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In 2000 the population aged 65 years old and over in Israel comprised 9.8% of the total population, and 4.3% were 75 years old and over. During the last three decades the proportion of the population over 75 years old, generally labeled the "old-old," has increased four times while the total population doubled [1]. The rapid increase in the number and proportion of older people has wide-ranging implications – social, medical, and economic. The main impact is on medical expenditures as the elderly utilize a disproportionately large share of healthcare services and medications. According to a frequently quoted article on drug use [2], the population aged 65 years and older, who represent 12.4% of the population in the United States, take 31% of all prescription drugs. In Israel, a study that estimated the relative part of different age groups in the utilization of healthcare services found that the population 65 and over utilized 30% of the total expenditure on health of the health insurance funds [3].

Numerous studies have described the patterns and trends of drug utilization of the community-dwelling elderly population in the USA and Europe [4–18]. Most of the studies also addressed drug utilization by therapeutic groups [4–8,10–12,14,15,17]. To the best of our knowledge, data have not been published on drug utilization by the different segments of the Israeli population in general and the elderly in particular. The aims of the present study are: a) to assess the patterns of drug use among the Jewish community-dwelling individuals aged 75–94 years, and to identify the socio-demographic and health determinants of drug use; and b) to examine drug use according to therapeutic categories by gender and origin.

Materials and Methods

The data on medication use were derived from the Cross-Sectional And Longitudinal Aging Study (CALAS). The detailed design is reported elsewhere [19]. In brief, the original CALAS population consisted of a random stratified sample of the Israeli Jewish population 75–94 years old who were alive in January 1989. The sample was selected from the National Population Registry and was stratified by gender, four age groups (75–79, 80–84, 85–89, 90–94) and three groups of place of birth: Israel, Asia-Africa (i.e., Middle Eastern or North African origin), and Europe-America (mostly of European origin) – a total of 24 strata. One hundred subjects were randomly selected from each stratum. Of the 1,820 interviewed individuals in the baseline study, 1,487 were living in the community, and for 19.2% of them proxy interviews were conducted. For 113 proxy interviews, the information on drug use was incomplete, and for 5 individuals the information was missing. The final study population consists therefore of 1,369 community-dwelling elderly aged 75–94 years who were interviewed between 1989 and 1992 in their homes. Multilingual trained interviewers conducted interviews after receiving written consent.

At the time of the interview, 95% of the residents of Israel and 99% of the interviewees were insured in one of four health insurance funds. Medication expenses were covered by the insurance and were supplied for a nominal fixed low charge per item. Since medications that could be purchased over-the-counter were also prescribed by the physician, no distinction was made between the two types of drugs in the present analysis.

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* Deceased

As part of the study, detailed information on drug use was collected. Interviewees were asked if they were currently taking prescribed or self-prescribed drugs for a specified list of medical conditions (heart disease, hypertension, diabetes, etc.). They were requested to display the containers of all medications they were taking, and the name, strength, dosage and duration of use were recorded. A coding system was developed whereby each drug was given a four digit code: the first two digits represented the therapeutic class, and the next two served for assigning a number for every drug in the group. For the purpose of the present analysis, drugs were grouped into 13 therapeutic groups based on the groups of the Monthly Ethical Drug Indexed Compilation (MEDIC) [20].

The relevant co-variates included in this analysis were classified into four groups:

- *Sociodemographic characteristics*. These include age, gender, origin, living arrangements, education and income. The categories of living arrangement were: living alone, living with spouse (with or without others), and living with other family members. Income and education were expressed as dichotomous variables. For income the categories included: only national insurance benefits (Bituah Leumi), and those who have in addition to national insurance other incomes. For education the categories included 8 years of education or less, and those with more than 8 years.
- *Health status*. This was expressed by the number of reported medical conditions, i.e., co-morbidity, and by the number of reported disabilities in instrumental activities of daily living [21]. The presence of medical conditions was determined from the positive answer to a list of predefined conditions. The list included the following 16 conditions: hypertension, diabetes, heart attack, other heart disease, stroke, arthritis, osteoporosis, respiratory, gastrointestinal, circulatory, urinary tract or kidney diseases, Parkinson's disease, hip fracture, cancer, anemia and dizziness. The activities included in the IADL measure were: preparing meals, daily shopping, shopping for clothes, handling personal finances, light housework, heavy housework, taking the bus, doing laundry. and using the telephone;
- *Healthcare utilization*. This was represented by the number of doctor's visits during the last month, and the number of hospitalizations during the last year;
- *Health habits*. These were expressed by physical activity, social activity, smoking, and alcohol consumption. Physical activity was defined by the number of times a week the subject performed the following activities: walking up to 2 kilometers, working outdoors, or performing other sport activities. Social activity was defined as performing at least one of the following activities: participating in synagogue services, volunteer activities, or going out with friends. Moderate alcohol use was defined as having more than one drink several times a week.

Statistical analysis

The statistical analysis was performed using SUDAAN [22] software. This software was designed for the analysis of complex survey designs and in our case enabled to adjust for the effects of

IADL = instrumental activities of daily living

stratification by age, gender and origin. The mean number of drugs taken and the proportion of drug users presented in the analyses are weighted population estimates for the Jewish Israeli community-dwelling old-old. Weighting was used to account for the effects of stratification and non-response. To assess the univariate relationship between the number of drugs used and each of the co-variates, analysis of variance was performed for categorical co-variates; and for interval predictors (number of medical conditions, number of IADL disabilities, number of hospitalizations, and number of doctor visits) a simple linear regression was performed. For predicting the number of drugs used, the four groups of predictor variables: sociodemographic characteristics, health status, healthcare utilization, and health habits, were introduced successively into forward multiple regression analyses using procedure REGRESS in SUDAAN. In order to retain all subjects in the multivariate analyses, the missing values for education years and income were replaced with imputed scores. The comparison between the proportion of men and women taking drugs by therapeutic groups was performed using chi-square tests, and the comparisons between each pair of the three origin groups were performed using contrasts in logistic regression.

Results

Only 12.5% of the study population did not consume any drugs (16.6% of the men and 9.1% of the women), and 25% took more than five medications. Table 1 presents the weighted distribution and characteristics of the study population, as well as the respective weighted mean number of drugs. The mean number of drugs taken by the total study group was 3.25. Drug use slightly increased by age in the first three age groups and decreased in the oldest age group 90–94, but the overall difference was not significant. Women took on the average one drug more than did males (3.7 and 2.7 respectively), and individuals of European origin reported taking significantly more drugs than Israeli-born and individuals of Middle Eastern and North African origin (3.4 vs. 2.7 in the latter two groups). No significant differences in the mean number of drugs used were observed by living arrangements, income, and education. According to the univariate analysis, the mean number of drugs taken was associated with the increase in number of medical conditions ($r = 0.56$, $P = 0.0002$), number of hospitalizations in the preceding year ($r = 0.34$, $P = 0.001$), number of doctor visits in the previous month ($r = 0.34$, $P = 0.001$), and number of IADL disabilities ($r = 0.19$, $P = 0.01$). Those who were physically active, socially active, and current smokers took significantly fewer drugs. Those who consumed moderate amounts of alcohol also took fewer drugs but the difference was not significant.

When the four groups of variables were introduced in the forward linear regression, variables that were not significantly related to drug use were removed from the next stage, except for the three stratification variables – age, gender, and origin – that were kept in all analyses. Thus, income and education were removed in the first stage, IADL disability in the second stage, and social activity and alcohol consumption in the last stage. Table 2 presents the final stage of the multiple linear regression analysis for predicting drug use. The majority of variables that were significantly

Table 1. Characteristics of community dwelling population 75–94 years old and mean number of drugs used (weighted data)

	Population distribution (%)	Mean no. of drugs	Standard error	P value
Total population	100.0	3.25	0.10	
● *Sociodemographic variables*				
Age				
75–79	59.2	3.18	0.15	
80–84	28.8	3.36	0.18	
85–89	9.9	3.41	0.19	
90–94	2.2	2.96	0.18	0.53
Gender				
Males	46.2	2.73	0.13	
Females	53.8	3.69	0.15	0.01
Origin				
Israel	3.3	2.71	0.13	
Asia-Africa	22.6	2.73	0.13	
Europe-America	74.1	3.43	0.13	0.02
Living arrangements				
Alone	40.9	3.32	0.18	
With spouse	46.3	3.20	0.15	
With others	12.8	3.17	0.22	0.82
Income				
National insurance and other income	57.8	3.22	0.13	
National insurance only	37.2	3.28	0.17	0.80
Missing	5.0			
Education (yrs)				
8 or less	51.1	3.14	0.12	
9 +	45.1	3.37	0.17	0.35
Missing	3.8			
● *Health status*				
No. of medical conditions*				
None	9.8	1.19	0.23	
1	19.9	1.72	0.14	
2–4	50.5	3.64	0.12	
5+	19.8	5.55	0.32	<0.001
IADL disability*				
Not disabled	47.8	2.67	0.15	
Disabled (1 or more disabilities)	52.2	3.79	0.15	0.01
● *Healthcare utilization*				
No. of hospitalizations last year*				
None	69.8	2.75	0.11	
1	22.8	4.01	0.24	
2	5.0	5.03	0.42	
3+	2.4	6.28	0.82	0.001
No. of doctor visits last month*				
None	39.5	2.29	0.13	
1 visit	35.0	3.53	0.18	
2–4	21.8	4.13	0.22	
5+	3.7	5.32	0.47	0.001
● *Health habits*				
Physical activity				
None	59.5	3.62	0.13	
1–2 times/week	12.4	3.03	0.29	
3+	28.2	2.55	0.21	0.03
Social activity				
No	46.1	3.58	0.16	
Yes	53.9	2.96	0.14	0.04
Smoking				
No	61.9	3.44	0.13	
Yes	10.1	2.26	0.26	
Past smoking	28.0	3.21	0.22	0.04
Alcohol use				
No	65.2	3.36	0.13	
Seldom	29.4	3.13	0.20	
Moderate	5.4	2.52	0.49	0.30

* P values give the significance of linear regression of number of drugs by the variable in continuous form

Table 2. Multiple linear regression analysis of number of drugs used, by four groups of covariates

	Beta coefficient	SE	P value
Intercept	0.19	0.55	0.75
● *Demographic characteristics*			
Age			
75–79 vs. 90–94	-0.01	0.20	0.97
80–84 vs. 90–94	0.23	0.22	0.35
85–89 vs. 90–94	0.31	0.23	0.24
Gender			
Males vs. females	-0.79	0.21	0.02
Origin			
Asia-Africa vs. Europe	-0.50	0.16	0.04
Israel vs. Europe	-0.68	0.15	0.01
Living arrangements			
Alone vs. with others	0.27	0.26	0.36
With spouse vs. with others	0.68	0.26	0.06
● *Health status*			
No. of medical conditions	0.51	0.05	0.001
● *Healthcare utilization*			
Hospitalization last year	0.55	0.14	0.02
Doctor visits last month	0.42	0.10	0.01
● *Health habits*			
Physical activity			
Yes vs. no	-0.19	0.11	0.16
Smoking			
Never vs. past	-0.12	0.21	0.59
Present vs. past	-0.41	0.28	0.20

$R^2 = 0.40$

related to drug use in the univariate analysis remained significant in the multivariate analysis. The contribution of each of the four groups of variables in explaining the variance in drug use was as follows: sociodemographic characteristics explained only 7% of the variance in drug use, and adding the number of medical conditions the percent of variance explained increased to almost 35%. Healthcare utilization added 4.5%, while the contribution of health habits was minor. All variables combined explained 40% of the variance in drug use.

Drug use by therapeutic groups, gender and origin is presented in Table 3. Fifty-three percent of the community-dwelling old-old were using cardiovascular drugs, and 29% were using more than one of these drugs. Thirty-one percent reported using psychotropic drugs, with women taking almost twice as many psychotropic drugs as men (39.5% and 21.2% respectively, $P = 0.01$). In most therapeutic groups women took more drugs than men but the differences were less significant. Individuals of European origin took significantly more cardiovascular and psychotropic drugs than those born in Asia-Africa and in Israel. Individuals born in Asia-Africa took significantly more analgesics than Israeli-born but fewer vitamins than those born in Israel and Europe-America.

Discussion

Close to 90% of the Israeli Jewish community-dwelling population aged 75–94 reported taking at least one medication, and the mean number of drugs consumed

Table 3. Proportion of drug use by therapeutic groups by gender and origin (weighted data)

		Gender			Origin			P values (contrasts)		
	Total	Males	Females	P value	Asia-Africa (AA)	Europe-America (EA)	Israel (IL)	EA vs. AA	EA vs. IL	AA vs. IL
Cardiovascular	53.0	50.6	55.0	NS	38.7	57.6	48.2	0.01	0.08	0.08
Diuretics & potassium supplements	26.0	21.8	29.6	0.10	24.3	26.7	23.0	NS	NS	NS
Analgesics	30.4	24.8	35.1	0.06	34.0	29.6	22.1	NS	0.10	0.03
Anti-inflammatory	12.3	9.0	15.2	0.09	16.1	11.3	9.0	0.15	NS	0.06
Psychotropic	31.0	21.2	39.5	0.01	18.7	35.1	23.5	0.01	0.03	NS
Other CNS drugs	6.5	5.1	7.6	NS	9.5	5.6	4.3	0.13	NS	0.06
Vitamins	19.8	15.1	24.0	0.06	14.5	21.3	23.8	0.09	NS	0.04
Gastrointestinal	27.6	22.0	32.3	0.05	21.7	29.6	22.1	0.08	0.10	NS
Metabolic & endocrine	17.0	12.9	20.6	0.08	15.1	17.7	14.5	NS	NS	NS
Respiratory	4.9	4.8	4.9	NS	5.9	4.5	4.1	NS	NS	NS
Infections	4.0	4.3	3.8	NS	5.8	3.5	3.4	NS	NS	NS
Genitourinary	1.9	2.5	1.3	NS	3.2	1.5	1.0	NS	NS	0.12
Ophthalmology & dermatology	8.7	9.4	8.1	NS	10.6	8.2	6.8	NS	NS	0.15

was 3.3. Drug utilization was significantly higher among women and individuals of European origin. The number of medical conditions was the variable most significantly related to drug use. Healthcare utilization was also significantly related to drug use.

In our study, the multivariate model explained 40% of the variability in drug use. The same percent of explained variance in overall drug use was found in Italy [15] in a sample of elderly people whose age was the same as our study group, although not all the variables included in their multivariate model were the same as ours. In the Duke EPESE study [9] and in the Hispanic EPESE study [16], the multivariate models explained 37% and 33% respectively of the variance in prescription drug use. As expected, health status, mainly as expressed by the number of co-morbid conditions, was the strongest predictor of drug use in these studies. Utilization of healthcare services and demographic characteristics were also predictors of drug use but explained only a small percent of the variance.

Most of the studies on drug utilization among the elderly population in the U.S. refer to the population aged 65 and over, and they analyzed prescription and non-prescription drugs separately. Nevertheless, comparisons of drug utilization between the two countries by age, gender and ethnic groups were feasible because in some studies it was possible to add prescription and non-prescription drugs. Both cross-sectional and longitudinal studies on drug utilization in the USA found significant associations of prescription drug use with increasing age [4,7,8,10,12,13], and no association with non-prescription drugs [4,6,7,10,14], or even a decrease in use with increasing age [18,24]. In our study, no significant trend in drug use by age was observed. Similarly, in the study in Italy [15] where both prescription and non-prescription drugs were analyzed together, no correlation between number of drugs and age was found. It is possible that the analysis of both types of drugs together conceals the effect of age.

The trend of higher rates and larger mean number of drugs reported by women than by men in our study is consistent with other studies that examined drug utilization by gender [6–

9,11,15,17]. The higher drug use by women can be explained by their significantly larger mean number of reported medical conditions and IADL disability [19]. Women consumed significantly more anti-inflammatory drugs, analgesics and psychotropic drugs. This result is consistent with the significantly higher reported prevalence of arthritis [19] and depressive symptoms by women in our study [23].

The finding of significantly lower drug use by individuals of Middle Eastern and North African origin than by those of European origin is not explainable by differential health or functional status. Based on the similar mean number of medical conditions and hospitalizations of the two origin groups (unpublished data) and higher disability rates among elderly of Middle Eastern and North African origin [19], similar or even higher levels of drug use could be expected among the latter. Although our data did not reveal differences in drug use by education and income, it is possible that the elderly of Middle Eastern and North African origin, who are characterized by lower socioeconomic status, could not afford to purchase drugs despite their low cost. This finding is consistent with studies in the U.S. that reported lower drug use among minority groups of lower socioeconomic status [9,13,16,17]. Individuals of Middle Eastern and North African origin took significantly fewer cardiovascular drugs than those of European origin, although they had similar rates of hypertension but lower rates of heart attacks and other heart diseases (unpublished data). Moreover, in spite of the high rates of depressive symptoms among individuals of Middle Eastern and North African origin [23], they were the lowest users of psychotropic drugs. The lower than expected and inconsistent trends of drug use by individuals of Middle Eastern and North African origin indicate that additional factors, other than health and socioeconomic status, determine the drug use patterns in this group. The differences are commonly attributed to cultural beliefs and larger reliance on home remedies since this group originates from a more traditional society. It is also reasonable to assume that the lower drug use in this group reflects poorer communication with the family physician due to language

and cultural barriers. This could have led to under-treatment of the elderly of Middle Eastern and North African origin and possible over-treatment of the other two origin groups who are more educated and also more informed regarding new and advanced treatments. The greater knowledge on drug availability of elderly born in Europe-America and Israel could also be the reason for differential use of non-prescription drugs. Non-prescription drugs that were widely used included analgesics, vitamins and gastro-intestinal drugs. Although these drugs were available over-the-counter, they were often prescribed by the physician. We found the highest use of analgesics among individuals of Middle Eastern and North African origin, and it is possible that the doctor prescribed these drugs more often to individuals of this group as first treatment of symptoms and complaints. The higher use of vitamins among individuals of European origin and Israeli-born is probably due to their higher awareness of the preventive effect of these drugs, and they either asked the doctor to prescribe them or could afford to purchase them out-of-pocket. The prevalence of gastro-intestinal diseases was similar among the three origin groups, but those of Asian-African origin took significantly fewer gastrointest-inal drugs. Laxatives are the most commonly used drug in this therapeutic group and we assume that their lower use by individuals of Asian-African origin was due to the custom to use home remedies as an alternative treatment.

The present study has some limitations. First, the assessment of drug use is based on self-report of the elderly, and compliance with prescribed drug regimens was not examined. However, the method of in-home medication inventory was found to be a reliable and valid method of obtaining data on drug use [8]. In the study by Nobili et al. [15], data collected at home were even more complete than data collected by the general practitioner. In another study [24], the agreement on medication use between interview data and medical records was found to be better than between interviews and pharmacy records. Moreover, in one study drug exposure in the home inventory was taken as the gold standard in investigating the validity of drug exposure in pharmacy records [25]. Second, the study was performed on a sample that represented the population in 1989, and since then there have been major changes in the composition of the elderly population mainly due to the massive immigration from the former Soviet Union. Immigrants aged 75 years and over who arrived in Israel since 1990 comprised 19% of the old-old in Israel at the end of 2000 [1], and the patterns of drug use in this group are unknown.

After the termination of our study a new drug policy was introduced in Israel as a result of the implementation of the National Insurance Law in 1995. The new law guaranteed, among other things, health insurance for all residents of Israel and a defined basket of services including a list of reimbursed drugs. The law intended to bring more equality and older people were supposed to benefit from it; however, after implementation of the law the out-of-pocket expenditures on drugs greatly increased, mainly due to the steep increase in co-payments for prescription drugs. The escalation in drug expenditure may cause under-use of effective drugs by the elderly of lower socioeconomic status, may increase the already existing disparity in drug use by origin groups,

and may lead to increased morbidity and disability in some sectors of the community-dwelling elderly. The main strength of the study is that the data are based on a nationwide stratified sample and the findings on differential drug use allow inference to the community-dwelling Jewish elderly population. However, further investigation is required to assess the effect of the new drug policies and the change in the composition of the elderly population on the patterns of drug utilization by the different subgroups of the Israeli elderly.

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