# Population Group Differences in Cognitive Functioning in a National Sample of Israelis 50 Years and Older

**Liat Ayalon[1], Jeremia Heinik[2], and Howard Litwin[3]**

## Abstract

This study evaluates population group differences in the cognitive functioning of Israelis 50 years and older. Groups were defined based on year of arrival and preferred language (e.g., veteran Israeli Jews, who arrived in Israel more than two decades ago; new immigrants from the former Soviet Union; and Israeli Arabs). Conducting a cross-sectional analysis of the first wave of SHARE-Israel (the Survey of Health, Aging and Retirement in Europe), the authors found that relative to veteran Israeli Jews, new immigrants from the former Soviet Union were significantly more likely to rate their reading ability as impaired. In addition, there was a significant interaction between population group and education on the arithmetic task. Whereas both veteran Israeli Jews and Israeli Arabs were less likely to demonstrate impaired performance on this task as their level of education increased, new immigrants from the former Soviet Union were less impaired than the other two groups, unrelated

[1]Bar Ilan University, Ramat Gan, Israel
[2]Ichilov Hospital, Tel Aviv, Israel
[3]Hebrew University of Jerusalem, Israel

**Corresponding Author:**
Liat Ayalon, Louis and Gabi Weisfeld School of Social Work, Bar Ilan University, Ramat Gan, Israel 52900
Email: ayalonl@mail.biu.ac.il

to educational level. New immigrants were more impaired on the verbal learning task. However, relative to veteran Israeli Jews, Israeli Arabs were significantly less likely to have an impaired performance on the verbal recall task. Findings are somewhat in contrast with the international literature that has consistently shown that the majority culture outperforms relative to ethnic minorities.

In the past few decades, there has been an increasing interest in understanding cognitive functioning and identifying those factors that affect cognitive functioning in old age (Cullum et al. 2000). It is well known that cognitive functioning is not a uniform global domain but instead is composed of several domains, such as learning, memory, executive function, and attention. These, in turn, also do not represent uniform global abilities but can be further subdivided into multiple subdomains, such as verbal learning, visual learning, episodic memory, short-term memory, word fluency, abstract reasoning, and so forth (Treitz, Heyder, and Daum 2007). Whereas research on cognitive functioning and decline is well developed in certain countries, such as the United States and England, less is known about cognitive functioning and cognitive variability in Israel. Hence, the present review of the literature is largely based on knowledge obtained in other countries.

## Population Group Differences in Cognitive Functioning

There are well-documented ethnic differences in cognitive performance (Ng et al. 2007; Schwartz et al. 2004), cognitive decline (Moody-Ayers et al. 2005), and cognitive impairment (Shadlen et al. 2006). Research has consistently shown that people of the majority culture outperform minority groups on most cognitive tests (Ng et al. 2007; Schwartz et al. 2004) and have slower age-related cognitive decline and a lower risk for dementia (Shadlen et al. 2006) relative to minority groups. These differences have been partially attributed to education level and other lifestyle variables that distinguish between different ethnic groups (Sachs-Ericsson & Blazer 2005), such as familiarity with the majority culture, test-taking skills, and language skills (Froehlich, Bogardus, and Inouye 2001; Sachs-Ericsson & Blazer 2005). However, because environmental factors such as educational level and early childhood socioeconomic status only partially explain ethnic differences in cognitive function (Ng et al. 2007; Sachs-Ericsson and Blazer 2005; Schwartz

et al. 2004), several researchers have identified genetic mechanisms, such as the ApoE genotype, to partially account for ethnic disparities in cognitive function (Fillenbaum et al. 2001).

## Population Group Differences in Israel

The distinction between veteran Israeli Jews, new immigrants from the former Soviet Union, and Israeli Arabs has been maintained in several recent epidemiological studies of older adults in Israel (Central Bureau of Statistics 2004). Maintaining this distinction is recommended for several reasons. First, the majority of older Israelis were not born in Israel, but came to Israel several decades ago. In contrast, more than 19% of older Israelis immigrated to Israel from the former Soviet Union during the most recent immigration wave in the early 1990s and, thus, have experienced the immigration process at old age (Central Bureau of Statistics 2004). These new immigrants have very different characteristics from more veteran populations of older Israelis. They are known to be older and more educated but to have lower income relative to veteran Israeli Jews. Second, Arab Israelis have very unique religious and sociocultural characteristics that distinguish them from the Jewish population in Israel. The Israeli Arab population represents the largest minority group in the country, with Israeli Jews encompassing only 77.2% of the total population (Central Bureau of Statistics 2004). The Israeli Arab population is substantially younger and less educated than the Israeli Jew population. In addition, Israeli Arabs have lower mean income and lower life expectancy relative to Israeli Jews. These unique characteristics of the three largest and most distinguishable population groups in Israel justify a comparative study to better evaluate their unique abilities and needs.

Similarly to the rest of Western society, Israel has been facing an increasingly aging population. Given the well-documented relationship between age, cognitive decline, and functional impairment, it is particularly important to evaluate the cognitive functioning of older Israelis, as this information can have important public policy and public health implications and assist in meeting the increasing needs of our aging society. As already noted, to date research on the cognitive functioning of older Israelis has been scarce, with the majority of research relying on nonrepresentative samples and limited cognitive screens. Furthermore, the majority of this research evaluated each population group separately and failed to compare cognitive functioning across population groups. The limited research conducted has shown that Israeli Jews likely have a similar prevalence rate of dementia as the known prevalence in the West (Treves et al. 1986). Whereas some differences between Jews of different geographical origins were found, these differences

were attenuated once educational level was taken into consideration (Kahana et al. 2003). In contrast, researchers found a significantly higher prevalence rate of dementia among the Arabs who reside in Wadi Ara (a geographical area in Israel; Bowirrat et al. 2001). These high rates of dementia were only partially accounted for by well-known environmental and genetic factors (Bowirrat et al. 2002; Farrer et al. 2003).

## The Present Study

The overall goal of this study was to evaluate population group differences in cognitive functioning using a national sample of Israelis 50 years and older and to compare the three largest population groups in Israel (e.g., veteran Jews, new immigrants from the former Soviet Union, and Israeli Arabs). In addition to between-group differences on the various cognitive measures, we examined within-group differences and the impact that various demographic variables have on cognitive performance within each ethnic group. To our knowledge, this is the first national study to evaluate the cognitive functioning of commu-nity-dwelling Israelis. The study has the advantage of evaluating several cognitive domains including orientation to time, verbal learning and recall, word fluency, and arithmetic and of using measures that were specifically tai-lored for cross-cultural comparisons (Prince et al. 2003). The study also includes a subjective evaluation of each respondent's reading and writing abilities. Given the scarcity of comparative data on population group differences in Israel, in forming our research hypotheses we relied on the general literature that sug-gests that the majority group tends to outperform relative to the minority group. Hence, we expected veteran Israeli Jews to outperform on all cognitive tests relative to Israeli Arabs, even once well-known covariates such as age, gender, income, education, and smoking behaviors were taken into account. We had no a priori hypotheses about new immigrants from the former Soviet Union; on the one hand, given the significant impact of immigration on one's mental health, one would expect new immigrants from the former Soviet Union to have a significantly lower performance than that of veteran Israeli Jews. However, on the other hand, given the fact that this is a highly educated popula-tion, it is unclear how it differs from the population of veteran Israeli Jews.

## Method

The analysis uses data from SHARE-Israel, the Israeli component of the Survey of Health, Aging and Retirement in Europe (Borsch-Supan et al. 2005), which is a multidisciplinary study of people age 50 years and older that is based

on the U.S. Health and Retirement Study. Sampling was based first on ecological units (statistical areas) and then on households within these units. We first stratified all statistical areas in Israel, taking advantage of the highly segregated residential patterns that exist. The strata are based on the geographical and sociodemographic characteristics of the statistical areas: community size, modal religion in the statistical area (Jews, Moslems, Christian Arab, and Druze, or mixed Jewish–Arab areas), percentage of new immigrants from the former Soviet Union, proportion with low education, and areas with high concentrations of ultraorthodox Jews. These criteria are all necessary for the construction of a representative sample of the Israeli population. Data were collected between September 2005 and March 2006. (For additional information about sampling design and procedure, see Litwin and Sapir 2008.)

Questionnaires were administered by trained interviewers in Hebrew, Arabic, and Russian, according to the language preferences of participants. The main survey was executed by means of computer-assisted personal interviews. Specific training was given to interviewers regarding the administration of the cognitive measures. The study, administered by the Israel Gerontological Data Center, was approved by the institutional review board of the Hebrew University of Jerusalem. All participants signed an informed consent prior to taking part in the interview. Participation was voluntary.

## Measures

*Cognitive functioning*. All cognitive measures were obtained in face-to-face interviews conducted by surveyors specifically trained in their administration.

*Subjective reading*. The SHARE questionnaire evaluates subjective reading ability using the question "How would you rate your everyday reading ability?" Following SHARE multisite criterion, responses to this question were dichotomized to reflect those who reported their reading ability to be poor, fair, or good versus those who reported their reading ability to be very good or excellent (Borsch-Supan et al. 2005).

*Subjective writing*. The SHARE questionnaire evaluates subjective writing ability using the question "How would you rate your everyday writing ability?" Following SHARE multisite criterion, responses to this question were dichotomized to reflect those who reported their writing ability to be poor, fair, or good versus those who reported their writing ability to be very good or excellent (Borsch-Supan et al. 2005).

*Time orientation*. The SHARE questionnaire assesses participants' knowledge of year, month, day of the month, and day of the week. To reflect overall time orientation, we summed all accurate responses (range 0-4). We used

SHARE multisite criteria to divide the sample into those who made no errors versus those with one or more errors (Borsch-Supan et al. 2005).

*Arithmetic*. Arithmetic ability was evaluated using four questions, for example, "If the chance of catching a disease is 10%, how many people out of 1,000 are expected to catch the disease." The response range was 0 to 4. Following SHARE multisite criteria, a score of 3 or lower was indicative of impairment (Borsch-Supan et al. 2005).

*Verbal learning*. The SHARE questionnaire evaluates learning using the adapted 10-Word Delay Recall Test (Prince et al. 2003). The list of 10 words was read to participants, and the number of spontaneously recalled words from the list following the first time the list was read was documented. The measure has been previously used in several international studies (Prince et al. 2003). Score range was 0 to 10. Following SHARE multisite criteria, a score of 4 or lower represented impairment in verbal learning (Borsch-Supan et al. 2005).

*Verbal recall*. Five minutes following the verbal learning task, participants were asked to spontaneously recall the list of words. Score range was 0 to 10. Following SHARE multisite criteria, a score of 4 or lower represented impairment in verbal recall (Borsch-Supan et al. 2005). It is important to note that, by definition, the verbal recall task highly depends on performance on the verbal learning task.

*Word fluency*. The SHARE questionnaire evaluates word fluency using the animal fluency task. Participants were asked to name all the animals they could think of in a one-minute trial. Participants received 1 point for each correct animal name. Following SHARE multisite criteria, a score of 18 or lower represented impairment in word fluency (Borsch-Supan et al. 2005).

*Population group*. Population group (e.g., veteran Israeli Jews, Israeli Arabs, new immigrants from the former Soviet Union) was determined based on language used during the interview (e.g., Hebrew, Arabic, or Russian, respectively) and immigration date. Veteran Israeli Jews have been living in Israel for more than two decades, whereas new immigrants came to Israel from the early 1990s on, following the fall of the Soviet Union.

*Covariates*. Age (50-59, 60-69, 70-79, 80 and older), gender, level of education (primary, secondary, tertiary), household income (divided into quartiles), and ever smoked (yes or no) were gathered based on self-report.

## Statistical Analyses

We first ran univariate analyses to obtain descriptive information about the sample. Next, we ran multivariate analyses with each of the cognitive domains

as an outcome variable, population group as a predictor, and all other sociode-mographic variables (i.e., age, gender, education, income, ever smoke) as covariates. To evaluate within-group differences, we also assessed for inter-actions between population group and each of the demographic variables. Due to multiple comparisons and the relatively large sample size, we consid-ered $p < .01$ as statistically significant in order to avoid spurious findings. To account for the complex sampling design, all analyses were weighted, strati-fied by population group, and clustered by household. All analyses were conducted using STATA 8 intercool, using the svy command to adjust for survey design.

## Results

Overall, 1,774 households participated in the study (68.6% response rate), with responses received from 2,603 individuals. Because the primary sam-pling unit was household (i.e., all family members who live in a household were eligible), the base sample included a small number of younger spouses. In the present study, analyses were conducted only on those who were 50 and older at the time interviews were conducted (2,492 individuals; 8.7% Arab, 19.0% Russian).

The majority of the sample was between the ages 50 and 59 (44.1%), female (54.9%), and with secondary level of education (50.4%). There were significant population group differences in gender, level of education, income, and smoking habits. The Arab sample had a larger representation of men, and the new immigrants had a larger representation of women, $\chi^2(2) = 110.1$, $p = .0004$. In addition, relative to veteran Israeli Jews, the Arab sample was significantly less educated and new immigrants from the former Soviet Union were significantly more educated, $\chi^2(4) = 680.3$, $p < .0001$. Veteran Israelis had a significantly higher income than the other two groups, $\chi^2(6) = 251.8$, $p < .0001$, and were significantly more likely to ever smoke, $\chi^2(2) = 81.4$, $p < .001$ (see Table 1 for details).

A total of 47% of the population rated their reading ability as poor, fair, or good, and 50% of the population rated their writing ability as poor, fair, or good. Overall, 20% of the population had at least one error on the time orien-tation task and 53% generated fewer than 18 animal names on the word fluency task. A total of 78% of the sample made at least one mistake in arith-metic. Last, 49% of the sample was classified as performing at the impaired range on the verbal learning task and 79% demonstrated an impaired perfor-mance on the recall task.

**Table 1.** Demographic Characteristics of the Sample by Population Group

| | | Population groups | | | |
| --- | --- | --- | --- | --- | --- |
| | Overall sample (N = 2,492) | Veterans (n = 1,974) | Arabs (n = 331) | Immigrants (n = 187) | $\chi^2$ |
| Gender | | | | | 110.1** |
| Female | 1,182 (54.9) | 1,030 (55.6) | 31 (23.9) | 121 (66.3) | |
| Age | | | | | 16.0 |
| 50-59 | 1,000 (44.1) | 793 (44.3) | 147 (50.2) | 60 (40.5) | |
| 60-69 | 788 (25.6) | 582 (24.9) | 129 (30.5) | 77 (26.3) | |
| 70+ | 704 (30.1) | 599 (30.7) | 55 (19.2) | 50 (30.1) | |
| Education | | | | | 680.3** |
| Primary | 627 (19.7) | 388 (18.8) | 237 (70.6) | 2 (0.1) | |
| Secondary | 1,244 (50.4) | 1,112 (57.5) | 67 (21.6) | 65 (37.0) | |
| Tertiary | 614 (29.7) | 467 (23.6) | 27 (7.7) | 120 (62.8) | |
| Income | | | | | 251.8** |
| Lowest quartile | 616 (27.6) | 391 (24.0) | 157 (47.5) | 68 (32.4) | |
| Second quartile | 628 (24.7) | 451 (20.0) | 112 (37.1) | 65 (37.0) | |
| Third quartile | 626 (27.1) | 531 (29.1) | 53 (12.0) | 42 (26.3) | |
| Fourth quartile | 622 (20.4) | 601 (26.8) | 9 (3.3) | 12 (4.2) | |
| Ever smoked | | | | | 81.4** |
| Yes | 1,021 (38.9) | 892 (44.4) | 82 (23.1) | 47 (25.5) | |

Note: Results in parentheses are reported as frequency (%).
**$p < .001$.

## Population Group Differences in Cognitive Functioning

With regard to reading ability, employing $p < .01$ as a criterion for statistical significance, we found that new immigrants from the former Soviet Union were more likely to rate their reading as impaired. In addition, older adults and less educated individuals also were more likely to rate their reading as impaired (see Table 2). None of the interactions were significant at $p < .01$: population group and gender (odds ratio [OR] = 1.44, 95% confidence interval [CI] = 0.82-2.53), population group and age (OR = 1.21, 95% CI = 0.53-1.59), population group and education (OR = 0.84, 95% CI = 0.69-1.03), population group and income (OR = 0.99, 95% CI = 0.99-.99), and population group and smoking (OR = 1.03, 95% CI = 0.89-1.18).

**Table 2.** Multivariate Analyses of Population Group as a Predictor of Reading and Writing Abilities, Controlling for Demographic Variables (N = 2,492)

| | Reading ability[a] | | Writing ability[b] | |
|---|---|---|---|---|
| | Odds ratio | 95% confidence interval | Odds ratio | 95% confidence interval |
| Group | | | | |
| Veterans (reference) | 1 | | 1 | |
| Arabs | 0.87 | 0.47-1.61 | 0.89 | 0.51-1.56 |
| New immigrants | 2.47** | 1.32-4.60 | 2.14 | 1.11-4.09 |
| Gender | | | | |
| Male (reference) | 1 | | 1 | |
| Female | 0.78 | 0.51-1.19 | 0.80 | 0.52-1.24 |
| Age | | | | |
| 50-59 (reference) | 1 | | 1 | |
| 60-69 | 2.53** | 1.52-4.20 | 1.95** | 1.18-3.21 |
| 70+ | 4.21** | 2.44-7.28 | 4.25** | 2.43-7.43 |
| Education | | | | |
| Primary (reference) | 1 | | 1 | |
| Secondary | 0.28** | 0.17-0.46 | 0.33** | 0.21-0.53 |
| Tertiary | 0.15** | 0.08-0.27 | 0.13** | 0.07-0.24 |
| Income | | | | |
| Lowest quartile (reference) | 1 | | 1 | |
| Second quartile | 1.36 | 0.83-2.24 | 1.29 | 0.77-2.15 |
| Third quartile | 1.02 | 0.54-1.91 | 0.83 | 0.43-1.58 |
| Fourth quartile | 0.83 | 0.41-1.66 | 0.65 | 0.32-1.30 |
| Ever smoked | | | | |
| No (reference) | 1 | | 1 | |
| Yes | 0.80 | 0.53-1.20 | 0.88 | 0.60-1.31 |

[a]Logistic regression was conducted to identify the role of population groups as predictors of reading ability, controlling for demographic variables, $F(11, 1,661) = 8.16$, $p < .001$.
[b]Logistic regression was conducted to identify the role of population groups as predictors of writing ability, controlling for demographic variables, $F(11, 1,660) = 8.93$, $p < .001$.
**$p < .01$.

With regard to writing ability, employing $p < .01$ as a criterion for significant results, there were no population group differences. As expected, older age and lower level of education were associated with the respondent's rating

of his or her writing ability as impaired (see Table 2). Using $p < .01$ as a criterion, there were no significant interactions between population group and gender (OR = 1.51, 95% CI = 0.85-2.68), population group and age (OR = 1.18, 95% CI = 0.90-1.56), population group and education (OR = 0.78, 95% CI = 0.62-.98), population group and income (OR = 0.99, 95% CI = 0.99-1.00), and population group and smoking (OR = 1.06, 95% CI = 0.92-1.22).

On the time orientation task, employing $p < .01$ as a criterion for statistical significance, there were no population group differences. Older age and lower levels of education were significantly associated with impaired performance on this task. In addition, those at the highest income quartile demonstrated better performance on this task (see Table 3). There were no significant interactions between population group and age (OR = 1.27, 95% CI = 0.89-1.82), population group and gender (OR = 0.41, 95% CI = 0.18-0.93), population group and education (OR = 0.94, 95% CI = 0.74-1.20), population group and income (OR = 0.99, 95% CI = 0.99-1.00), and population group and smoking (OR = 1.03, 95% CI = 0.83-1.26).

On the arithmetic task, employing $p < .01$ as a criterion for statistical significance, there was a significant interaction between education and population group, as can be seen in Figure 1. Whereas both veteran Israeli Jews and Israeli Arabs were less likely to demonstrate impaired performance on this task as their level of education increased, new immigrants from the former Soviet Union were less impaired than those in the other two groups, unrelated to educational level. In addition, women were more likely to demonstrate an impaired performance on this task. There were no other significant interactions between group and gender (OR = 1.19, 95% CI = 0.71-2.01), group and age (OR = 1.23, 95% CI = 0.85-1.77), group and income (OR = 1.00, 95% CI = 0.99-1.00), and group and smoking (OR = 0.98, 95% CI = 0.86-1.12).

On the verbal learning task, employing $p < .01$ as a criterion for statistical significance, there were significant group differences, with new immigrants showing greater impairment on the verbal learning task. Older adults and less educated individuals also were more likely to perform at the impaired range (see Table 4).

There were no significant interactions between group and gender (OR = 0.95, 95% CI = 0.52-1.72), group and age (OR = 1.01, 95% CI = 0.79-1.30), group and education (OR = 0.89, 95% CI = 0.73-1.08), group and income (OR = 0.99, 95% CI = 0.99-0.99), and group and smoking (OR = 0.97, 95% CI = 0.84-1.11).

On the verbal recall task, employing $p < .01$ as a criterion for statistical significance, Arab Israelis were significantly less likely to perform at the

**Table 3.** Multivariate Analyses of Population Group as a Predictor of Orientation and Arithmetic, Controlling for Demographic Variables (N = 2,492)

| | Orientation[a] | | Arithmetic[b] | |
|---|---|---|---|---|
| | Odds ratio | 95% confidence interval | Odds ratio | 95% confidence interval |
| **Group** | | | | |
| Veterans (reference) | 1 | | 1 | |
| Arabs | 0.71 | 0.37-1.36 | 3.10 | 1.31-7.30 |
| New immigrants | 0.71 | 0.29-1.76 | 20.63** | 3.62-117.49 |
| **Gender** | | | | |
| Male (reference) | 1 | | 1 | |
| Female | 1.08 | 0.63-1.86 | 1.92** | 1.18-3.11 |
| **Age** | | | | |
| 50-59 (reference) | 1 | | 1 | |
| 60-69 | 1.33 | 0.78-2.27 | 1.53 | 0.93-2.54 |
| 70+ | 3.56** | 1.83-6.91 | 1.62 | 0.84-3.13 |
| **Education** | | | | |
| Primary (reference) | 1 | | 1 | |
| Secondary | 0.29** | 0.17-0.48 | 1.09 | 0.43-2.75 |
| Tertiary | 0.08** | 0.04-0.16 | 0.79 | 0.43-7.37 |
| **Income** | | | | |
| Lowest quartile (reference) | 1 | | 1 | |
| Second quartile | 0.64 | 0.36-1.11 | 2.02 | 1.14-3.59 |
| Third quartile | 0.74 | 0.35-1.57 | 1.88 | 0.98-3.57 |
| Fourth quartile | 0.25** | 0.12-0.49 | 1.33 | 0.68-2.61 |
| **Ever smoked** | | | | |
| No (reference) | 1 | | 1 | |
| Yes | 1.13 | 0.70-1.80 | 0.65 | 0.41-1.03 |
| Group × Education | – | – | 0.69** | 0.58-0.83 |

[a]Logistic regression was conducted to identify the role of population groups as predictors of orientation ability, controlling for demographic variables, $F(11, 1,666) = 11.56, p < .001$.
[b]Logistic regression was conducted to identify the role of population groups as predictors of arithmetic ability, controlling for demographic variables, $F(12, 1,665) = 6.21, p < .001$.
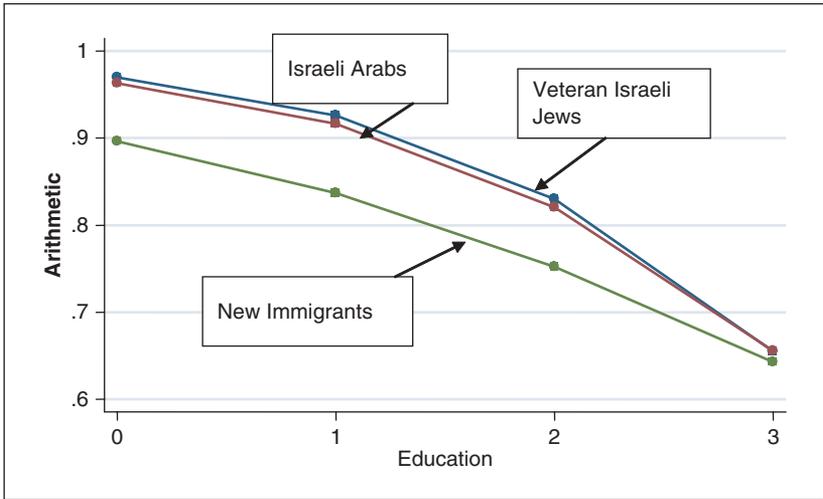**$p < .01$.

**Figure 1.** Population group and education as predictors of arithmetic ability
Note: For arithmetic, a higher score represents a greater likelihood of impairment. For education, a higher score represents more years of education.

impaired than were veteran Israeli Jews. In addition, older adults were more likely to demonstrate impaired performance on this task (see Table 4).

There were no significant interactions between group and gender (OR = 0.94, 95% CI = 0.43-2.06), group and age (OR = 0.94, 95% CI = 0.64-1.37), group and education (OR = 0.85, 95% CI = 0.65-1.13), group and income (OR = 0.99, 95% CI = 0.99-1.00), and group and smoking (OR = 0.90, 95% CI = 0.75-1.09).

On the word fluency task, employing $p < .01$ as a criterion for statistical significance, there were no significant group differences. As expected, older age and lower level of education were associated with impaired performance (see Table 5).

There were no significant interactions between group and gender (OR = 1.01, 95% CI = 0.61-1.66), group and age (OR = 0.91, 95% CI = 0.70-1.18), group and education (OR = 0.88, 95% CI = 0.72-1.07), group and income (OR = 0.99, 95% CI = 0.99-0.99), and group and smoking (OR = 1.02, 95% CI = 0.90-1.16).

## Discussion

This study is unique because it evaluates the cognitive functioning of Israelis 50 years and older, using a national representative sample. To our knowledge,

**Table 4.** Multivariate Analyses of Population Group as a Predictor of Verbal Learning and Verbal Recall, Controlling for Demographic Variables ($N = 2,492$)

| | Verbal learning[a] | | Verbal recall[b] | |
|---|---|---|---|---|
| | Odds ratio | 95% confidence interval | Odds ratio | 95% confidence interval |
| **Group** | | | | |
| Veterans (reference) | 1 | | 1 | |
| Arabs | 0.44 | 0.23-0.84 | 0.31** | 0.16-0.60 |
| New immigrants | 2.65** | 1.38-5.07 | 1.23 | 0.49-3.08 |
| **Gender** | | | | |
| Male (reference) | 1 | | 1 | |
| Female | 0.70 | 0.46-1.06 | 0.63 | 0.36-1.12 |
| **Age** | | | | |
| 50-59 (reference) | 1 | | 1 | |
| 60-69 | 2.09** | 1.30-3.37 | 2.06 | 1.05-4.02 |
| 70+ | 6.30** | 3.62-10.98 | 6.02** | 2.13-16.97 |
| **Education** | | | | |
| Primary (reference) | 1 | | 1 | |
| Secondary | 0.34** | 0.20-0.56 | 0.43 | 0.22-0.83 |
| Tertiary | 0.18** | 0.10-0.34 | 0.49 | 0.22-1.05 |
| **Income** | | | | |
| Lowest quartile (reference) | 1 | | 1 | |
| Second quartile | 0.78 | 0.46-1.33 | 0.81 | 0.43-1.49 |
| Third quartile | 0.71 | 0.37-1.38 | 0.40 | 0.16-0.97 |
| Fourth quartile | 0.88 | 0.45-1.73 | 0.71 | 0.34-1.49 |
| **Ever smoked** | | | | |
| No (reference) | 1 | | 1 | |
| Yes | 1.50 | 1.01-2.22 | 1.53 | 0.87-2.69 |

[a]Logistic regression was conducted to identify the role of population groups as predictors of word learning ability, controlling for demographic variables, $F(11, 1,654) = 8.51, p < .001$.
[b]Logistic regression was conducted to identify the role of population groups as predictors of verbal recall ability, controlling for demographic variables, $F(11, 1,655) = 3.64, p < .001$.
**$p < .01$.

this is the first national study of older Israelis that evaluates cognitive functioning comparing these three different population groups. Furthermore, the range of cognitive tasks administered in this study and the fact that these were specifically tailored for cross-cultural comparison allow for a detailed evaluation of a variety of cognitive domains across population groups.

**Table 5.** Multivariate Analyses of Population Group as a Predictor of Word Fluency, Controlling for Demographic Variables (*N* = 2,492)

| | Word Fluency[a] | |
|---|---|---|
| | Odds ratio | 95% confidence interval |
| Group | | |
| Veterans (reference) | 1 | |
| Arabs | 1.21 | 0.63-2.31 |
| New immigrants | 1.63 | 0.87-3.07 |
| Gender | | |
| Male (reference) | 1 | |
| Female | 0.91 | 0.61-1.38 |
| Age | | |
| 50-59 (reference) | 1 | |
| 60–69 | 2.21** | 1.33-3.38 |
| 70+ | 7.11** | 3.83-13.20 |
| Education | | |
| Primary (reference) | 1 | |
| Secondary | 0.36** | 0.21-0.62 |
| Tertiary | 0.27** | 0.14-0.51 |
| Income | | |
| Lowest quartile (reference) | 1 | |
| Second quartile | 1.17 | 0.70-1.95 |
| Third quartile | 0.91 | 0.46-1.79 |
| Fourth quartile | 0.99 | 0.51-1.91 |
| Ever smoked | | |
| No (reference) | 1 | |
| Yes | 0.72 | 0.49-1.06 |

[a]Logistic regression was conducted to identify the role of population groups as predictors of word fluency ability, controlling for demographic variables, $F(11, 1,650) = 7.29$, $p < .001$.
**$p < .01$.

More than half of the sample had impaired performance on the arithmetic task, verbal recall task, and word fluency task, and a little less than half of the sample had an impaired performance on the word learning task. Furthermore, almost half of the sample reported impaired reading and writing abilities. Given the well-established relationship between cognitive function and functional limitations (Moody-Ayers et al. 2005), it is highly likely that a large segment of the Israeli population older than 50 requires assistance in daily function. However, it is important to note that for comparability reasons, we used the universal criteria currently in use by SHARE-Europe. Whereas the performance of Israelis on these cognitive tasks is similar to the performance

of respondents in some European countries (e.g., France or Italy on the arith-metic task), respondents from other European countries have demonstrated superior performance on these same cognitive tasks (e.g., Denmark and the Czech Republic; Borsch-Supan et al. 2005). Hence, based on the present results, it is possible that further development of specific norms for the Israeli population is warranted.

Our findings regarding population group differences are inconsistent with our initial hypotheses and necessitate further qualitative and quantitative research to better understand the results. Relative to veteran Israeli Jews, Israeli Arabs were less likely to have an impaired performance on the verbal recall tasks, whereas new immigrants from the former Soviet Union were significantly more likely to an impaired performance on the verbal learning task. These results are surprising given past research that found higher levels of dementia among Arabs in Wadi Ara (Bowirrat et al. 2002). They also are surprising given research that has shown that the majority group usually outperforms minority groups on cognitive tasks (Ng et al. 2007; Schwartz et al. 2004). One explanation for these findings is that the well-developed oral tradition among Arabs might have affected their ability to recall a list of words in the present study. The new immigrants from the former Soviet Union, on the other hand, had been uprooted from their coun-try of origin more than a decade prior to the SHARE study. Thus, it is possible that at the time of evaluation their verbal abilities both in their native lan-guage and in the host language were not as adequate, and as a result, their performance on the verbal learning task was impaired. Further research of these hypotheses is necessary to better understand the findings.

Another interesting finding of this study is that, relative to veteran Israeli Jews, new immigrants from the former Soviet Union were significantly more likely to report impaired reading ability. Because the evaluation of reading and writing abilities asks about everyday performance, it is possible that the new immigrants reported their ability to read Hebrew rather than Russian, even though the interviews were conducted in Russian. It is important to note that this group, by definition, arrived in the country in the early 1990s. Hence, they all were required to learn Hebrew as adults. This, of course, makes the acquisition of a new language more difficult. It also is important to note that reading ability is a subjective, rather than objective, measure of cognitive functioning, and responses may simply represent the lower mental state of this group of new immigrants. The use of cognitive interviews to further examine this finding is recommended.

An interesting finding concerns the performance of the various groups on the arithmetic task. Whereas the performance of both veteran Israeli Jews and Israeli Arabs was quite comparable and largely affected by their educational

level, so that at higher levels of education these groups were likely to exhibit less impairment, this was not the case for new immigrants from the former Soviet Union, whose performance was better and much less affected by their educational level. One potential explanation for this is that level of education in this study was determined by years of education, which may not necessarily reflect the quality of education. It is possible that in the former Soviet Union even people with lower levels of education were exposed to mathematical education. This may not have been the case for veteran Israeli Jews and Arabs.

Last, in support of the validity of our findings regarding population group differences, results further suggest that, similar to the world literature, age and education are the best predictors of performance on the variety of cognitive domains evaluated in the present study. In addition, similar to the rest of Western society, the findings confirm the presence of gender disparities in arithmetic in this Israeli sample.

## *Limitations*

The use of norms developed by SHARE-Europe may not be appropriate for the Israeli sample. However, given no other established criteria and in order to improve comparability, we decided to use the norms used by SHARE-Europe, the European equivalent of this study. Nonetheless, it is important to note that these measures and specific cutoff criteria were established with a cross-cultural comparison in mind. In addition, the study focused on relatively heterogeneous population groups. For example, we did not distinguish between Christian Arabs and Muslim Arabs or between Jews born in Europe and those born in Africa. In addition, we did not specifically control for length of time in the country, as this variable was used to define the group of new immigrants. Finally, genetic markers, such as ApoE 3, that could potentially explain our results were not collected as part of the SHARE study, and hence, no genetic explanations can be evaluated.

Nevertheless, this study is the first national sample to evaluate the cognitive functioning of Israelis 50 years and older, using a variety of cognitive screens specifically tailored for cross-cultural comparison. Unexpectedly, new immigrants were significantly more likely to report impaired reading ability. In addition, Israeli Arabs were significantly more likely to perform adequately on the recall tasks, whereas new immigrants were significantly more likely to have an impaired performance on the verbal learning task. In addition, the performance of new immigrants from the former Soviet Union on the arithmetic task was less affected by their level of education, relative to the performance of the other two population groups. These findings regarding

disparities across population groups need to be further explored using both qualitative and quantitative tools. Findings also suggest a need for further research to distinguish between oral tradition, years of education, and quality of education as determinants of cognitive functioning.

## Declaration of Conflicts of Interest

## Funding

## References

Borsch-Supan, A., A. Brugiavini, H. Jurges, J. Mackenbach, J. Siegrist, and G. Weber. 2005. *Health, Aging, and Retirement in Europe: First Results From the Survey of Health, Aging, and Retirement in Europe*. Manheim, Germany: MEA. Retrieved July 1, 2007 (http://www.share-project.org/index.php?page=Documentation&menue=4&sub=)

Bowirrat, A., R. P. Friedland, L. Farrer, C. Baldwin, and A. Korczyn. 2002. "Genetic and Environmental Risk Factors for Alzheimer's Disease in Israeli Arabs." *Journal of Molecular Neuroscience* 19:239-45.

Bowirrat, A., T. A. Treves, R. P. Friedland, and A. D. Korczyn. 2001. "Prevalence of Alzheimer's Disease Type Dementia in an Elderly Arab Population. *European Journal of Neurology* 8:119-23.

Central Bureau of Statistics. 2004. *Persons Aged 60 and Over in Israel: Findings From a Survey Conducted in 1997–1998*. Central Bureau of Statistics, Israel, Publication No. 1223.

Cullum, S., F. A. Huppert, M. McGee, T. Dening, A. Ahmed, S. P. Eugene, and C. Brayne. 2000. "Decline Across Different Domains of Cognitive Function in Normal Ageing: Results of a Longitudinal Population-Based Study Using CAM-COG." *International Journal of Geriatric Psychiatry* 15:853-62.

Farrer, L. A., R. P. Friedland, A. Bowirrat, K. Waraska, A. Korczyn, and C. T. Baldwin. 2003. "Genetic and Environmental Epidemiology of Alzheimer's Disease in Arabs Residing in Israel." *Journal of Molecular Neuroscience* 20:207-12.

Fillenbaum, G. G., L. R. Landerman, D. G. Blazer, A. M. Saunders, T. B. Harris, and L. J. Launer. 2001. "The Relationship of ApoE Genotype to Cognitive Functioning in Older African American and Caucasian Community Residents." *Journal of the American Geriatrics Society* 49:1148-55.

Froehlich, T.E., S. T. Bogardus, and S. K. Inouye. 2001. "Dementia and race: Are There Differences Between Caucasian Americans?" *Journal of the American Geriatrics Society* 49:477-84.

Kahana, E., Y. Galper, N. Zilber, and A. D. Korczyn. 2003. "Epidemiology of Dementia in Ashkelon: The Influence of Education." *Journal of Neurology* 250: 424-28.

Litwin, H. and E. Sapir, E. 2008. "Methodology: Structure and Content of SHARE-Israel" (in Hebrew). *Bitachon Sociali* 76:25-42.

Moody-Ayers, S. Y., K. M. Mehta, K. Lindquist, L. Sands, and K. E. Covinsky, 2005. "Black–White Disparities in Functional Decline in Older Persons: The Role of Cognitive Function." *Journals of Gerontology: Medical Sciences* 60A:933-39.

Ng, T. P., M. Niti, P. C. Chiam, and E. A. Kua. 2007. "Ethnic and Educational Differences in Cognitive Test Performance on Mini-Mental State Examination in Asians." *American Journal of Geriatric Psychiatry* 15:130-39.

Prince, M., D. Acosta, H. Chiu, M. Scazufca, M. Varghese, and 10/66 Dementia Research Group. 2003. "Dementia Diagnosis in Developing Countries: A Cross-Cultural Validation Study." *Lancet* 361:909-17.

Sachs-Ericsson, N. and D. G. Blazer. 2005. "Racial Differences in Cognitive Decline in a Sample of Community-Dwelling Older Adults: The Mediating Role of Education and Literacy." *American Journal of Geriatric Psychiatry* 13:968-75.

Schwartz, B. S., T. A. Glass, K. I. Bolla, W. Stewart, G. Glass, M. Rasmussen, J. Bressler, S. Weiping, and K. Bandeen-Roche. 2004. "Disparities in Cognitive Functioning by Race/Ethnicity in the Baltimore Memory Study." *Environmental Health Perspectives* 112:314-20.

Shadlen, M. F., D. Siscovick, A. L. Fitzpatrick, C. Dulberg, L. H. Kuller, and S. Jackson, 2006. "Education, Cognitive Test Scores, and Black–White Differences in Dementia Risk." *Journal of the American Geriatrics Society* 54:898-905.

Treitz, F. H., K. Heyder, and I. Daum. 2007. Differential Course of Executive Control Changes During Normal Aging. *Aging, Neuropsychology, and Cognition* 14:370-93.

Treves, T., A. D. Korczyn, N. Zilber, E. Kahana, Y. Leibowitz, M. Alter, and B. S. Schoenberg. 1986. "Presenile Dementia in Israel." *Archives of Neurology* 43:26-29.

## Bios

**Liat Ayalon** is a clinical geropsychologist and a senior lecturer at the Louis and Gabi Weisfeld School of Social Work, Bar Ilan University. Her research interests concern the mental health of older adults and the people who care for them.

**Jeremia Heinik** is a geriatric psychiatrist and the director of Margoletz Psychogeriatric Center, an outpatient clinic and daycare center specializing in cognitive impairment of the elderly at Ichilov Hospital in Tel Aviv. He is also a clinical lecturer in psychiatry in the Department of Psychiatry, Sackler Faculty of Medicine, at Tel Aviv University. His major areas of research and interest include cognitive assessment of the elderly with a special focus on the clock-drawing test, testamentary capacity assessment, mild cognitive impairment, and the history of geriatric psychiatry.

**Howard Litwin** is a professor of social gerontology at Hebrew University of Jerusalem. He has served as dean of the Paul Baerwald School of Social Work at Hebrew University, is the founding head of the Israel Gerontological Data Centre, and is the principal investigator of SHARE-Israel. His work includes more than 100 publications in the areas of social integration, social networks, intergenerational relations, and community care.