**Israel Journal of Health Policy Research**

ORIGINAL RESEARCH ARTICLE Open Access

# Do rich Israelis wait less for medical care?

Amir Shmueli

## Abstract

**Background:** Waiting time to receive medical care is a disturbing phenomenon in many healthcare systems. Furthermore, waiting times are usually distributed in the population in an inequitable way.

**Objectives:** In this paper we focus on one aspect of the possible inequities associated with waiting times for MRIs and elective surgeries – different waiting times by income level.

**Methods:** We used the CBS's 2009-2010 linked health-income data, which included 7,175 households (24,595 individuals). Actual waiting time for MRI and expected waiting time for surgeries were measured on a 4-categories ordinal scale. Both ordered probit and sample selection ordered probit – to account for possible correlation between the need for these services and the waiting time for them – were used to estimate the income effect on waiting time, controlling for a vast set of personal characteristics.

**Results:** Rich Israelis are more likely than poor ones to be, controlling for health state, on the waiting list for MRI, but not for surgeries. Income has no effect on the actual waiting time for MRI. Income has no effect on the expected waiting time for surgeries in the probit model, but has a significant negative effect in the sample selection model. Ownership of voluntary insurance increases the probability to be on the waiting list for both MRI and surgeries, but has no effect – as does having public finance only of the care – on waiting time. The results also show that sicker persons and those residing in the periphery wait longer for surgery.

**Conclusions:** We found some evidence that rich persons expect a shorter wait for surgeries, which is not explained by voluntary insurance ownership or by using private finance. We found solid evidence that the expected waiting time for surgeries is longer for sicker persons and those in the periphery. Further research with a larger sample based on actual waiting times might shed more light on the issue of waiting time for medical care and its distribution in Israel.

## Background

Waiting time to receive medical care is a disturbing phenomenon in many healthcare systems. As with the issue of consumer-cost sharing, policy makers are deliberating between viewing waiting time as a tool to reduce consumers' moral hazard and to increase efficiency, viewing waiting times as an indication of possible inefficiency in delivering care, and acknowledging the fact that waiting times are usually distributed in the population in an inequitable way. Furthermore, the issue of waiting times is generally related to the issue of private voluntary insurance ownership which by itself is a controversial policy issue.

In many OECD countries, long waiting times for health care services is an important health policy issue. A recent OECD survey [1] revealed problems with waiting times in almost all OECD countries including primary care, out-patient specialist care, emergency care, cancer care and elective (non-emergency) care. More than half of OECD countries have long waiting times for elective treatments, and these waiting times are often a contentious political issue.

In this paper we focus on one aspect of the possible inequities associated with waiting times for medical care – different waiting times by income level. National health insurance systems, such as in Israel, adopted the principles of equality and fairness. In order to enable the achievement of these principles, the delivery of care is totally separated from the income of the insured. Evidence on inequality in waiting times in general and according to income, in particular, raises a "red flag" in the society.

Relating (reliable) income data to waiting times on an Israeli national level was made possible by the linkage, performed by the Central Bureau of Statistics, of the 2009 Health survey with the 2010 Income survey. Due

Correspondence: amirsh@ekmd.huji.ac.il
The Hebrew University-Hadassah School of Public Health, Jerusalem, Israel

to data limitations, we focused on waiting times to MRIs and to elective surgeries performed in hospitals. While MRIs and surgeries are associated with a major burden of illness, the yearly number of patients needing them is small (1-2%). Consequently, a major limitation of the database is the small number of cases.

## Methods

### Data

The data we used was taken from a Central Bureau of Statistics file which linked information on households from two surveys. The first survey, which was conducted in 2009, gathered socio-demographic and health information. The second survey, carried out in 2010, gathered both individual and household information regarding incomes. Of the 8,713 households (28,968 individuals) who responded to the health survey, 7,175 (24,595) – aver 80% - were matched with information from the income survey. The main reason for non-match was the dynamics of households' formation: individuals change households and the match has no comparative meaning. Naturally, the rate of non-match is higher in the 20-40 age group. The linked data constitute a unique source of information, including health, use of health services as well as income data.

We were interested in evaluating how different variables – and in particular income - impact the length of time Israelis need to wait for medical care. We focus, restricted by the way the questions were asked, on scheduled (at the time of the interview) surgeries and on MRIs which were taken during the year prior to the interview.

### MRI

Out of 28,968 individuals in the health survey, 559 (2%) underwent a MRI in the previous year. 82 of the 559 were conducted during hospitalization. We focused on the remaining 477 individuals whose MRI was not c while being hospitalized. For 460 individuals data on waiting times and incomes were available. They include publicly and privately financed MRIs.

The actual length of the wait for the MRI was divided (in the interview) into four ordered categories: less than one month, one to three months, three to six months and six to twelve (the maximal wait was less than 1 year).

### Surgeries

Out of 28,968 individuals in the health survey, 295 (1%) had a *scheduled* surgery at the time of the interview. Because only 18 of the 295 surgeries were to be carried out outside of a hospital, we focused on the remaining 278 individuals whose surgeries - publicly or privately financed - were to be carried out in a hospital.

Because the surgeries that the survey referred to were surgeries scheduled in the future (as opposed to MRIs that were already carried out in the past year), the survey broke the wait into two periods: from the time the individual was registered to the surgery until the date of the survey and from the date of the survey until the scheduled date of the surgery. Of the 278 cases where the individual was waiting for a surgery in a hospital, in 91 cases a specific date for the surgery was not reported. The answer reported was "as recommended by the doctor". After excluding these cases and an additional five cases in which the individual did not know the length of the wait, we remained with 182 surgeries scheduled to be done in a hospital whose length of wait and income were known.

Both periods had the same four options as in MRIs (up to a month, 1-3 months, 3-6 months and 6-12 months). Expected waiting time for surgery was defined of the sum of two waiting periods. Because there were relatively few inpatients and nine separate (but sometimes overlapping) waiting categories, we combined categories and were left with four ordered categories; (1) expected wait is less than 2 months, (2) 2-3 months, (3) expected wait is 4-5 months, and (4) 6-12 months.

We also had information regarding the type of surgery to be conducted (8 categories: eye, e.n.t., heart, stomach or digestive system, gynecology or urinary tract, orthopedic, blood vessels and other). Because of the small numbers of surgical patients, we chose to use the pooled data, disregarding the type of surgery.

### Independent variables

The focal variable income was indicated by the household's monthly net income per standardized adult (in thousands IS). Health was measured by the number of chronic sicknesses (out of ten: high blood pressure, heart attack, other heart diseases, stroke, diabetes, asthma, chronic lung disease, chronic disease in the digestive system, cancerous disease and depression or anxieties) reported by the individual.

The additional covariates were: place of MRI (hospital or community), age (in 20 age groups, from 0 to 85+), sex, ownership of voluntary health insurance (yes vs. no), public finance only of the MRI / the surgery (yes, possibly with some copayment vs. any private finance), peripheral status (peripheral vs. intermediate or center), origin (Israel and former USSR vs. all other, including Arabs) and level of education (12+ vs. up to 12 years of schooling).

### Statistical strategy

#### *MRIs*

In order to evaluate the income's and other variables' effects on the length of the wait for an MRI we ran an Ordered Probit regression with the length of wait

measured by the 4-level scale as the dependent variable and income and all the variables mentioned above as explanatory variables. An indicator whether the MRI was taken in an outpatient clinic or in the community was introduced as well.

### Surgeries

We ran an Ordered Probit regression on the expected 4-level waiting time variable for surgeries using the same set of explanatory variables as we did with MRIs excluding place of MRI.

### Accounting for the selectivity of MRI/surgeries users

The above analysis is conditional on having been registered for a MRI or surgery. The effects of the independent variables on waiting time might be biased since the need for a MRI or surgery is not random and may be correlated with these independent variables. In the second part of the analysis we used the Heckman Selection Model to account for such correlation. The Heckman model specifies a 2 equation model: first, a Probit model for the probability of needing a MRI or surgery, and the second equation specifies the waiting time (Ordered Probit). The first equation applies to the entire sample and the second – to the selected sample of those needing a surgery, but the (non-zero) correlation between the two equations is accounted for. For MRI, the identifying variable was voluntary insurance ownership. Voluntary insurance ownership affects the use of services, but once using public finance only - or having made any private finance - of the procedure is held constant, it does not expect to exercise an effect on waiting time. For surgeries, education served as the identifying variable. The effect of education on the use of services is well known. Its effect on expected waiting time, controlling for income, is assumed to be small, since while higher education is correlated with better navigation of the medical bureaucracy, this applies more (at least in Israel) to the stage of getting a referral for the procedure.

The model was estimated using maximum likelihood. In all runs, since the coefficients of the Ordered Probit models have no clear meaning, we present the marginal effects of the independent variables on the probabilities to belong to the specific waiting time categories. The Additional file 1 presents the cut points and their 95% CIs. These cut points divide the normal distribution into segments which are assumed to underlay the waiting categories.

## Results

### MRI

Table 1 panel A presents the description of the population which underwent a MRI in the year prior to the interview. The mean waiting time (computed based on the categories' midpoints) was 1.6 months (median = 0.5 months). 56% of the treated persons were women, mean age was 12 (of 20 age groups), namely, 45-49, and income per standardized adult was 4,917 IS. The mean number of chronic conditions was 1.1. 13% of the treated population resided in a peripheral location, and 57% were of Israeli born or former USSR origin. 49% had more than 12 years of schooling.

87% owned voluntary private insurance, and the share of MRI users whose MRI was completely financed publicly was 82%. These two variables are significantly related ($p = 0.004$). While all those who did not own voluntary insurance had their MRI financed completely publicly, 21% of those who owned voluntary insurance had public finance only of their MRI. Among those who had public finance only, 3% owned voluntary insurance. Both voluntary insurance ownership and having a public finance only are significantly related to income (positively at $p = 0$ and negatively $p = 0.06$ respectively). After some experimentation with the estimation of the

**Table 1 Variables means**

| A. MRI (n = 460) | Mean | Std. Err. | [95% Conf. interval] | |
|---|---|---|---|---|
| Waiting time (months)* | 1.588 (median = 0.5) | 0.088 | 1.414 | 1.762 |
| MRI in hospital | 0.714 | 0.024 | 0.667 | 0.761 |
| Female | 0.556 | 0.026 | 0.505 | 0.608 |
| Age | 12.278 | 0.214 | 11.858 | 12.698 |
| Income per standardized adult (in thousands IS) | 4.917 | 0.165 | 4.593 | 5.241 |
| Voluntary insurance ownership | 0.873 | 0.018 | 0.838 | 0.907 |
| Public finance only | 0.823 | 0.015 | 0.793 | 0.852 |
| Number of chronic illnesses | 1.079 | 0.076 | 0.930 | 1.228 |
| Peripheral location | 0.128 | 0.017 | 0.094 | 0.162 |
| Israel or former USSR origin | 0.571 | 0.026 | 0.520 | 0.622 |
| Education 12+ years | 0.488 | 0.003 | 0.481 | 0.494 |
| **B. Surgeries (n = 182)** | **Mean** | **Std. Err.** | **[95% Conf. Interval]** | |
| Expected waiting time (months)* | 3.473 (median = 2.5) | 0.175 | 3.127 | 3.819 |
| Female | 0.445 | 0.042 | 0.363 | 0.527 |
| Age | 11.999 | 0.436 | 11.137 | 12.860 |
| Income per standardized adult (in thousands IS) | 3.996 | 0.222 | 3.556 | 4.435 |
| Voluntary insurance ownership | 0.814 | 0.035 | 0.746 | 0.882 |
| Public finance only | 0.694 | 0.010 | 0.676 | 0.712 |
| Number of chronic illnesses | 1.005 | 0.106 | 0.795 | 1.215 |
| Peripheral location | 0.231 | 0.035 | 0.162 | 0.301 |
| Israel or former USSR origin | 0.475 | 0.042 | 0.392 | 0.559 |
| Education 12+ years | 0.488 | 0.003 | 0.482 | 0.495 |

*Calculated based on the categories' mid-points.

models, we decided to include the variable indicating public finance only in the waiting time equation and voluntary insurance ownership in the use of MRI equation.

Table 2 panel A describes the distribution of waiting time for MRI. 59% of the MRIs were performed after less than a month waiting. Another 31% were performed after waiting for 1-3 months. In 10% of the cases, waiting time was longer than 3 months. The distribution is quite similar between MRI in the community and in an outpatient clinic.

Table 3 indicates that waiting time for MRI is not related to any of the individual characteristics, including income. Waiting for an outpatient clinic MRI is longer than the wait for MRI performed in a community clinic. Similarly, the sample selection model (Table 4 panel A) shows no significant determinants of waiting time for MRI (the Additional file 1 shows further that in fact all cut points are not significantly different from zero and the model does not correspond to the data) .

From Table 4 panel B it is clear that advanced age and worse health are positively related to the likelihood of having a MRI. Controlling for age and the number of chronic sicknesses, income has a significant positive effect and so does ownership of voluntary insurance. In other words, while rich persons are more likely to undergo a MRI, controlling for age and sickness, their waiting time is similar to that of poor persons.

### Surgeries

We first tried to see whether having a missing value on the expected waiting time due to "the date of the surgery was determined by the recommendation of the doctor" is random. It turned out that this group includes more women than in the valid sample (66% vs. 44%); has a lower mean income (IS3,316 vs. IS 3,996); is sicker (1.5 chronic conditions on average vs. 1) and is less educated (78% with less than 12 years of schooling vs. 64% in the valid sample). Consequently, the working sample is somewhat medically and socio-economically stronger than the population waiting for surgeries.

**Table 2 The distribution of waiting time for MRI and for surgeries (%)**

| A. Actual waiting time for MRI in months | Total MRI | MRI in hospital | MRI in the community |
|---|---|---|---|
| Up to 1 | 59 | 59 | 60 |
| 1-3 | 31 | 31 | 32 |
| 3-6 | 7 | 6 | 8 |
| 6-12 | 3 | 4 | - |
| Total | 100 | 100 | 100 |
| n | 460 | 331 | 129 |
| **B. Expected waiting time for surgeries in months** | **All surgeries** | **Eye surgeries** | **Orthopedic surgeries** |
| Up to 1 | 31 | 32 | 20 |
| 2-3 | 23 | 23 | 26 |
| 4-5 | 23 | 24 | 25 |
| 6-12 | 23 | 21 | 29 |
| Total | 100 | 100 | 100 |
| n | 182 | 35 | 44 |

Table 1 panel B presents the variables' means among persons who are on the waiting list for an inpatient surgery. The mean expected waiting time is 3.5 months (median = 2.5 months). 44% of the population were women, mean age was 12 (of 20 age groups), namely, 45-49, and mean income per standardized adult was IS3,996. The mean number of chronic conditions was one. 23% of the population resided in a peripheral location, and 48% were of Israeli born or former USSR origin. 48% had more than 12 years of schooling.

81% owned voluntary private insurance, and the share whose surgery is to be financed from public money only was 69%, less than the 82% found among users of MRI. Among those who owned voluntary insurance, 36% had any private finance in their future surgery. The corresponding rate among MRI users was 21%. Furthermore, among those who had no voluntary insurance, 15% had some out of pocket finance of their prospective surgery. Among those who had any private finance of their surgery, 90% owned voluntary insurance. Rich persons are more likely to own voluntary insurance ($p = 0$) and to make any private finance ($p = 0.005$). As with waiting for MRI, after some experimentation with the estimation of the models, we decided to include the variable indicating public finance only in the waiting time equation and voluntary insurance ownership in the being on the waiting list for surgery equation.

Table 2 panel B shows that 31% have an expected waiting time of less than a month. The remaining 69% are distributed uniformly across the waiting time categories of 2-3, 4-5 and 6+. Waiting time for orthopedic surgeries – the biggest single type of surgery – is somewhat longer, while that for eye surgeries – the second biggest type – is distributed in a similar way to its distribution among all persons on waiting lists for surgeries.

Table 5 shows, first, that income has no significant effect on none of the probabilities of the waiting time categories. Two characteristics do exercise significant effects: number of chronic conditions and peripheral location. Sicker persons or those residing in the periphery wait longer than healthy persons or persons waiting for a surgery in the center.

In the sample selection model of expected waiting for surgery (Table 6 panel A), the income effect is significant: rich Israelis are likely to wait shorter times than otherwise similar poor persons. As was found in the ordered probit model, sicker and persons waiting in the periphery are

**Table 3 Ordered Probit marginal effects (M.E.) on the probability to belong to the various waiting time categories for MRI**

| | Up to 1 month | | 2-3 months | | 4-5 months | | 6-12 months | |
|---|---|---|---|---|---|---|---|---|
| | **M.E.** | **z** | **M.E.** | **z** | **M.E.** | **z** | **M.E.** | **z** |
| Hospital (vs. in the community) | **-0.124** | -2.35 | **0.067** | 2.33 | **0.036** | 2.31 | **0.022** | 1.98 |
| Female (vs. male) | 0.081 | 1.74 | -0.044 | -1.72 | -0.023 | -1.68 | -0.014 | -1.6 |
| Age | 0.001 | 0.19 | -0.001 | -0.19 | 0.000 | -0.19 | 0.000 | -0.19 |
| Income per standardized adult (in thousands IS) | 0.014 | 1.29 | -0.007 | -1.29 | -0.004 | -1.25 | -0.002 | -1.23 |
| Public finance only | 0.092 | 1.59 | -0.049 | -1.58 | -0.026 | -1.53 | -0.016 | -1.51 |
| Number of chronic illnesses | 0.005 | 0.28 | -0.003 | -0.28 | -0.001 | -0.28 | -0.001 | -0.28 |
| Peripheral location | -0.067 | -0.97 | 0.036 | 0.97 | 0.019 | 0.94 | 0.012 | 0.97 |
| Israel or former USSR origin | 0.078 | 1.49 | -0.042 | -1.48 | -0.022 | -1.44 | -0.014 | -1.43 |
| Pseudo R squared =0.02 | | | | | | | | |

Bold = significantly different from zero at p = 0.05.

likely to expect a longer wait for a surgery. Women tend to wait less than men as well. We note that planning "public finance only" toward the surgery has no effect on the expected waiting time in both models. This effect remains zero even when income is excluded from the equations.

Table 6 panel B presents the marginal effects of the personal characteristics on the probability to have a surgery scheduled. While income has no effect, all the other covariates exercise significant marginal effects: women are more likely to be on the waiting list for a surgery than men; older persons – than young ones; those with voluntary health insurance - than those without; sick persons – than healthy persons; in the periphery – than in the center; and persons with higher education – less than persons with lower education.

## Discussion

The findings indicate that 60% of those who had a MRI waited less than a month. This rate is somewhat lower than the rate found in a later population survey (Brammli-Greenberg et al. [2]) of 77%. While the likelihood of having an MRI is affected by the age, health status, income and voluntary insurance ownership, actual waiting time to MRI is not related to any of the personal characteristics, and in particular, income does not have any effect

**Table 4 Sample Selection marginal effects (M.E.) on the probability to belong to the various waiting time categories for MRI**

| ***A. Waiting time equation (Ordered Probit)*** | Up to 1 month | | 2-3 months | | 4-5 months | | 6-12 months | |
|---|---|---|---|---|---|---|---|---|
| | **M.E.** | **z** | **M.E.** | **z** | **M.E.** | **z** | **M.E.** | **z** |
| Hospital (vs. in the community) | -0.054 | -0.35 | -0.049 | -1.14 | 0.003 | 0.02 | **0.100** | 1.98 |
| Female (vs. male) | 0.041 | 0.38 | 0.038 | 0.88 | -0.002 | -0.02 | -0.077 | -1.33 |
| Age | 0.005 | 0.80 | 0.004 | 0.37 | 0.000 | -0.02 | -0.008 | -0.45 |
| Income per standardized adult (in thousands IS) | 0.006 | 0.39 | 0.005 | 0.78 | -0.001 | -0.02 | -0.001 | -1.11 |
| Public finance only | 0.056 | 0.63 | -0.044 | -0.73 | -0.009 | -0.41 | -0.003 | -0.36 |
| Number of chronic illnesses | 0.018 | 1.00 | 0.017 | 0.36 | -0.001 | -0.02 | -0.034 | -0.44 |
| Peripheral location | -0.029 | -0.33 | -0.026 | -0.77 | 0.001 | 0.02 | 0.054 | 0.92 |
| Israel or former USSR origin | 0.034 | 0.36 | 0.031 | 0.91 | -0.002 | -0.02 | -0.063 | -1.29 |
| ***B. On the waiting list for MRI equation (binary probit)*** | | | | | | | | |
| Female (vs. male) | 0.061 | 1.38 | | | | | | |
| Age | **0.040** | 7.76 | | | | | | |
| Income per standardized adult (in thousands IS) | **0.013** | 2.16 | | | | | | |
| Voluntary insurance ownership | **0.275** | 4.28 | | | | | | |
| Number of chronic illnesses | **0.172** | 7.54 | | | | | | |
| Peripheral location | 0.001 | 0.02 | | | | | | |
| Education higher than 12 years | -0.011 | -0.21 | | | | | | |

Bold = significantly different from zero at p = 0.05.

**Table 5 Ordered Probit marginal effects (M.E.) on the probability to belong to the various waiting time categories for surgeries**

| | Up to 1 month | | 2-3 months | | 4-5 months | | 6+ months | |
|---|---|---|---|---|---|---|---|---|
| | **M.E.** | **z** | **M.E.** | **z** | **M.E.** | **z** | **M.E.** | **z** |
| Female (vs. male) | 0.085 | 1.37 | 0.013 | 1.19 | -0.022 | -1.28 | -0.076 | -1.37 |
| Age | 0.012 | 1.59 | 0.002 | 1.56 | -0.003 | -1.49 | -0.011 | -1.63 |
| Income per standardized adult (in thousands IS) | 0.016 | 1.58 | 0.002 | 1.24 | -0.004 | -1.61 | -0.014 | -1.51 |
| Public finance only | -0.013 | -0.21 | -0.002 | -0.21 | 0.003 | 0.21 | 0.012 | 0.21 |
| Number of chronic illnesses | **-0.061** | -2.04 | -0.009 | -1.71 | 0.016 | 1.87 | **0.054** | 2.06 |
| Peripheral location | **-0.217** | -3.13 | **-0.032** | -2.16 | **0.056** | 2.55 | **0.193** | 3.17 |
| Israel or former USSR origin | 0.064 | 1.04 | 0.010 | 0.97 | -0.017 | -1.03 | -0.057 | -1.04 |
| Pseudo R squared =0.0635 | | | | | | | | |

Bold = significantly different from zero at p = 0.05.

on the length of waiting. Brammli-Greenberg et al. Brammli-Greenberg et al. [2] report similar findings.

46% report an expected waiting time for elective surgeries greater than 4 months. Siciliani et al. [1] report that actual waiting time for elective surgeries in 2010 in OECD countries were much lower: 18% had waiting more than 4 months in Australia, 21% in the UK and in Norway, 22% in Sweden and 25% in Canada. Some of the gap might be related to the difference between actual and expected waiting times. Another source of bias might be the omission of about a (relatively sicker and poorer) third of our cases where waiting time was missing (the date "was determined by the recommendation of the doctor"), and in fact could be lower than 4 months.

The above OECD report compares the two types of waiting time measures: actual and expected. Actual waiting time naturally reflects reality. However, those who actually used the service do not form a random sample of those who scheduled the procedure. Some patients on the waiting list might give up the procedure, might be declined later by the treating doctors or might die. Expected waiting time might not be materialized in reality, but reflects the expectation – including past waiting – of all the patients on the waiting list at the time of the survey.

**Table 6 Sample selection marginal effects (M.E.) on the probability to belong to the various waiting time categories for surgeries**

| ***A. Waiting time equation(ordered probit)*** | **Up to 1 month** | | **2-3 months** | | **4-5 months** | | **6+ months** | |
|---|---|---|---|---|---|---|---|---|
| | **M.E.** | **z** | **M.E.** | **z** | **M.E.** | **z** | **M.E.** | **z** |
| Female (vs. male) | **0.006** | 2.06 | **-0.003** | -2.02 | **-0.002** | -1.99 | **-0.001** | -2.02 |
| Age | 0.000 | -0.91 | 0.000 | 0.92 | 0.000 | 0.88 | 0.000 | 0.88 |
| Income per standardized adult (in thousands IS) | **0.019** | 2.37 | **-0.001** | -1.99 | **-0.001** | -1.98 | **-0.001** | -1.98 |
| Public finance only | -0.001 | -0.1 | 0.001 | 0.1 | 0.000 | 0.1 | 0.000 | 0.11 |
| Number of chronic illnesses | **-0.005** | -3.30 | **0.003** | 2.94 | **0.001** | 3.07 | **0.001** | 3.03 |
| Peripheral location | **-0.013** | -3.50 | **0.007** | 3.19 | **0.004** | 3.15 | **0.003** | 3.04 |
| Israel or former USSR origin | 0.003 | 1.27 | -0.002 | -1.26 | -0.001 | -1.26 | -0.001 | -1.25 |
| ***B. On the waiting list for surgeries equation(binary probit)*** | | | | | | | | |
| | **M.E.** | **z** | | | | | | |
| Female (vs. male) | **-0.126** | -2.08 | | | | | | |
| Age | **0.036** | 4.45 | | | | | | |
| Income per standardized adult (in thousands IS) | -0.014 | -1.51 | | | | | | |
| Voluntary insurance ownership | **0.200** | 2.32 | | | | | | |
| Number of chronic illnesses | **0.130** | 4.21 | | | | | | |
| Peripheral location | **0.240** | 3.11 | | | | | | |
| Education higher than 12 years | **-0.114** | -2.10 | | | | | | |

Bold = significantly different from zero at p = 0.05.

Expected waiting time for surgeries, as opposed to waiting time for MRI, depends on several personal characteristics. In particular, when the unobserved correlation between waiting for a surgery and the length of the waiting is accounted for in a sample selection model, expected waiting time decreases with increasing income.

Also, it is longer for sicker persons and for residents of the periphery. The former finding might indicate the existence of implicit risk selection or cream skimming – by facing long waiting time, sicker unprofitable individuals might be induced to exit the queue or even to switch sickness funds. The longer wait in the periphery than in the center is probably a reflection of a generally lower supply of inpatient care in general (2.5 general beds per 1,000 residents in the center vs. 1.5 in the periphery. The Knesset, The Center for Research and Information [3], and in specific types of surgery waited for in particular: residents of the periphery are over represented among those waiting for ENT and blood vessels surgeries – both have higher than average (national) waiting time, and are underrepresented in eyes, digestion, and other surgeries, where mean wait is lower than average.

As was mentioned above, our working sample is somewhat healthier and richer than the population on the waiting list because of missing values on waiting time. The sign of the bias resulted depends on the actual waiting time of those with missing values on expected waiting time. If it is relatively long – as implied by our findings about the effect of health and income – than the true income effect is even larger. If the actual waiting time is relatively short, the true income effect is smaller.

Because the small number of cases, we could not account for heterogeneity originated from types of surgery. Some of the effects on waiting time might reflect differences in mean waiting time between the types of surgery. For example, women tend to have a surgery less than men, and they have shorter waiting times (Table 6 panel A). The mean wait for gynecological surgeries is 2.6 months, shorter than the overall mean wait (3.5 months), and this is probably the explanation for the gender-effect on waiting time. Advanced age and more reported chronic conditions are associated with a greater tendency to be on the waiting list for a surgery, and sicker persons wait for longer periods of time. The highest mean number of chronic conditions (1.7) is found among those waiting for eye surgeries, where mean waiting time is 3 months, lower than the overall average. However, the second highest mean number of chronic conditions (1.1) is found among those waiting for orthopedic surgeries, where mean wait is 4 months, above the overall mean.

Finally, what are the factors which might explain the result that rich persons wait less than poor persons? Again, one such channel is the assignment of persons to types of surgery, namely, that rich persons are waiting for shorter-waiting-time surgeries. The highest mean income (IS 5,142) is found among ENT surgeries, where mean waiting time is 3.6, quite close to the overall mean. The lowest mean income (IS 2,611) is found among surgeries performed on the blood vessels, where mean wait is the highest, 5 months (but the number of persons waiting for these surgeries is 6 only). Consequently, the correlation between income and type of surgery cannot account for the negative income effect on waiting time.

Private care is often used to shorten waiting times for surgery. In Israel, such use is financed by voluntary health insurance or out of pocket. Ownership of voluntary health insurance has a positive significant effect on the likelihood of having a MRI or a surgery, controlling for income and health, but it does not have any effect on waiting times. Having used public finance only toward the MRI or the surgery, controlling for income, does not have any effect on waiting times either.

## Conclusions

We do not find evidence indicating that, controlling for income and health, private finance shortens waiting times. We do find, subject to the limitations of the study mentioned above, that controlling for private finance and health, rich Israelis wait less. We found solid evidence that the expected waiting time for surgeries is longer for sicker persons and those in the periphery. Further research, based on actual waiting times and much bigger sample, might shed more light on this disturbing finding.

## Additional file

**Additional file 1: Cut-points in the waiting time ordered probit models.**

**Competing interest**
The author declares that he has no competing interest.

**Acknowledgments**
Yaron Marcus provided excellent research assistance. Special thanks are due to Naama Rotem of the CBS for her assistance in preparing the data file.

Received: 27 June 2014 Accepted: 24 August 2014
Published: 29 September 2014

**References**

1. Siciliani L, Borowitz M, Moran V (Eds): *Waiting Time Policies in the Health Sector: What Works?* France: OECD Health Policy Studies, OECD Publishing; 2013. http://dx.doi.org/10.1787/9789264179080-en.
2. Brammli-Greenberg S, Waitzberg R, Guberman D: *Waiting Times for (non-urgent) Ambulatory Services from Patients' Perspective.* Jerusalem: The Smokler Center for Health Policy Research, Meyers-JDC-Brookdale Institute; 2014.
3. The Knesset, The Center for Research and Information: *The General Hospitalization Sector in Israel in 2008.* Jerusalem: The Knesset, The Center for Research and Information; 2010.

doi:10.1186/2045-4015-3-30
**Cite this article as:** Shmueli: Do rich Israelis wait less for medical care? *Israel Journal of Health Policy Research* 2014 **3**:30.