# Associations of Demographic and Socioeconomic Factors with Complete Treatment and Follow-up of Colon Cancer

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## Abstract

**Background:** Cancer is the second cause of death in the world, and colon cancer is the third cause of death and is one of the most common cancers which will cure with early diagnosis, treatment and sufficient follow up. Assessing factors which affect this cancer is important for prolonging patient survival. Socioeconomic factors are among effective factors of cancer morbidity and mortality. Because mortality rates for colon cancers vary by socioeconomic characteristics, this study has been performed to recognize the relationship between socioeconomic factors with treatment and follow up of colon cancer.

**Methods:** This was a cross-sectional, descriptive study for patients with colon cancer registered in Cancer Research Center of Shahid Beheshti University of Medical Sciences from April 2005 to November 2006. Patients were selected randomly, and the study was conducted using questionnaires filled by interviewing the patients via phone (if a patient was dead, the questions were asked from their family members). Data analysis was done using SPSS (version 19) software.

**Results:** The study was performed on 520 colon cancer patients with age range of 23-88 years. The mean age of the patients was 63 (S.D.=11.8) and the median age was 64. Two hundred thirty seven (45.4%) patients were female and 283 (54.4%) were male. Using Chi-square test, age<60 (p=0.002) and female gender (p=0.034) had a significant correlation with complete treatment and there was a significant relationship between complete follow up and age<60 (p=0.037), academic education (p=0.02) and having insurance (p=0.021). Multiple logistic regression tests were used to evaluate concurrent effects of variables on treatment and follow up. Correlated variables to complete treatment include: age<60 (p=0.001), and female gender $(p = 0.023)$. The Odds Ratio (OR) of completing treatment for patients under 60 years of age versus patients above 60 years was 3.13 (95% C.I. 1.55 to 6.34), and the OR of completing treatment for women versus men was 1.91(95% C.I. 1.33 to 2.74). Correlated variables to follow up were academic education $(p = 0.018)$ and having insurance $(p = 0.046)$. The OR of cancer follow up in illiterate patients versus college-educated patients was 0.45 (95% C.I. 0.24 to 0.82), and the OR of cancer follow up in patients without insurance versus patients with health was 0.46 (95% C.I. 0.21 to 0.98).

**Conclusion:** Age is a correlated factor on completing colon cancer treatment. Women have more complete colon cancer treatment than men. Academic education and having insurance were the most important factors among socioeconomic factors observed in a five-year follow up after treatment. As the population of the old is increasing, executing effective interventions to improve treatment and follow up procedures for old patients is of prime importance. It seems that increasing the insurance contribution in follow up measures may lead to increase in the regular follow up and may affect patients' survival.

**Keywords:** Colon cancer; Treatment; Follow-up; Socioeconomic factors; Demography

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## Introduction

Cancer is one of the main causes of death that impose a heavy burden on the public health and pose a challenge to science. In 2007, 7.9 million deaths (13% of worldwide deaths) were due to cancer. In addition, its mortality is increasing gradually and will reach to 12 million in 2030 [1]. Cancer is the third cause of death after cardiovascular diseases and injuries in Iran [2]. Colon cancer is the third cause of cancer related deaths after lung and stomach cancers worldwide [1], and is the third cause of death after stomach and esophagus cancers in men and fourth after breast, esophagus and stomach cancers in women in Iran [3]. Population studies in Iran show an increase in average age of population, suggesting that cancers will rise in the future [2]. Increasing the prevalence of cancer in the future calls for more attention on its main casual factors besides developing diagnostic and treatment modalities. Strong evidence shows that socioeconomic status has a prominent effect on cancers [4- 6]. According to previous studies, people living in low socioeconomic level, have poor survival and more mortality, compared to high socioeconomic level [7, 8]. Following screening programs is more common in high socioeconomic status [9]. In low socioeconomic status, cancers are diagnosed rather in later stages concluding lower survival rate which is correlated to lower access to health care systems [8, 10]. Besides, socioeconomic level affects complete cancer cure that means patients of low socioeconomic level will not be cured completely [11].

With early diagnosis and treatment, colon cancer is almost one of the curable cancers, and its overall 5-year survival rate is 47% [12]. After complete treatment, regular follow-up helps recognition of any changes in patients' health and in early diagnose of the disease in conditions which cancer recurs or another cancer develops. Follow-up including colonoscopy, CEA protein test and CT-scan is performed on regular periods of time. Previous studies have paid less attention to the relationship between follow-up after colon cancer treatment and socioeconomic status. According to the significance of cancer and its association with socioeconomic characteristics, this study was performed to assess the relationship between these factors and colon cancer treatment and its follow up. The aim of this study was to assess the relationship between demographic and socioeconomic factors with treatment and follow-up of colon cancer.

## Materials and Methods

This was a cross-sectional, descriptive study conducted on patients with colon cancer registered in Cancer Research Center of Shahid Beheshti University of Medical Sciences from April 2005 to November 2006. This period of time was selected because the main period of follow up was completed in 5 years. Inclusion criteria were residency in Tehran in the mentioned period, and patients living out of Tehran were excluded.

The minimum sample size, with proportions of 0.50, a 95% confidence interval (Z=1.96) and precision of 0.05 (d), was 385.

From April 2005 to November 2006, 1700 patients referred to the Cancer Research Center of Shahid Beheshti University of Medical Sciences; of whom, 520 patients were selected using simple random sampling.

The questionnaire of demographic and socioeconomic factors was designed and included the following factors: age; gender marital status; socioeconomic factors (education, occupation, income; health insurance status); clinical factors (complete treatment and follow up).

Marital status included three groups: single, married and divorced.

Education was categorized into three levels: illiterate (0 year), diploma and less (1-12 years) and academic (>12 years).

Occupation was categorized into four groups: employed, unemployed, retired and housewives.

Income was categorized into four levels: first level (0), second level (less than 500,000), third level (500,000-1,000,000) and fourth level (>1,000,000) tomans. Housewives income was presumed to be first level.

Treatment status was categorized into two groups: complete treatment (patients who received treatment completely) and incomplete treatment (patients not completing their treatment procedure for any reason).

Cancer follow up was categorized into two groups: complete fallow up (patients who received follow up completely in a 5-year-period) and incomplete follow up (patients received 5- year follow up measures incompletely for any reason).

To collect data, telephone interview was done with the patients (if he/she was dead, the interview was done with family and relatives).Interviews were conducted with two college-educated individuals who were informed about the interview and questioning pattern.

**Table 1.** Descriptive statistics of colon cancer patients registered in Cancer Research Center of Shahid Beheshti University of Medical Sciences

|  | Classification | Frequency | Percent |
|---|---|---|---|
| **Age** | <60 | 195 | 37.6 |
|  | >60 | 324 | 62.4 |
| **Sex** | female | 237 | 45.6 |
|  | male | 283 | 54.4 |
| **Marital status** | single | 21 | 4.1 |
|  | married | 480 | 93.2 |
|  | divorced | 14 | 2.7 |
| **Education** | illiterate | 78 | 15.1 |
|  | Diploma and less | 354 | 39.1 |
|  | academic | 88 | 45.7 |
| **Income (toman)** | 0 | 203 | 39.2 |
|  | <500,000 | 130 | 25 |
|  | 500,000 – 1,000,000 | 148 | 28.5 |
|  | >1,000,000 | 38 | 7.3 |
| **Occupation** | employed | 123 | 23.7 |
|  | unemployed | 10 | 1.9 |
|  | retired | 193 | 37.1 |
|  | housewife | 194 | 37.3 |
| **Insurance** | No | 32 | 6.2 |
|  | Yes | 485 | 93.8 |

## Statistical Analysis

The statistical analyses were performed with SPSS (version19.0) software.

Data were represented as percentages and two-way tables. Variables were compared using the Chi-square test. Multivariate logistic regression analyses were performed to identify the independent predictors of outcomes. The Odds Ratio (OR) was computed for the outcome measures. A p value of less than 0.05 was considered statistically significant.

## Results

The study was conducted on 520 colon cancer patients with age range of 23-88 years. The mean age was 63 (S.D.=11.8) and the median age was 64 years. One hundred ninety five (37.6%) patients were less than 60 years of age, and 324 (62.4%) patients were 60 or older. Of the patients, 237 (45.6%) were female, and 283(54.4%) were male. Eighty eight (45.7%) patients had college education, and 78 (15 %) were illiterate. Two hundred and two patients (39%) had no income (194 of them were housewives), 130 (25%) had income of less than 500,000 Tomans, 148 (28.5%) had income between 500,000 to 1000,000 Tomans and 38 (7.3%) had income more than 1,000,000 Tomans. One hundred twenty three patients (24%) were employed, 193 (37%) retired, and 194 (37%) were housewives. Four hundred eighty five patients were insured, 485

(93.8%) and 32 (6.2%) were uninsured. The descriptive statistics of the patients are displayed in table 1.

Among 520 patients, 64 (12%) failed to complete their treatment and 456 (88%) completed their treatment (In the interview with the patient's relatives, some of them said "I don't know" in response to follow-up and treatment questions. Therefore, the total number of groups in different columns may not be completely equal. Nonetheless, the number of these responses was limited and had no significant effect on the sample size).

Chi square statistical test was used to assess the relationship between demographic and socioeconomic status with completion of treatment and follow-up. Demographic variables including age (p=0.002) and gender (p=0.034) had a significant correlation with treatment; other variables, however, had no significant correlation. Eighty eight patients (16.7%) did not complete their follow-up, and 432 (83.3%) completed their follow-up. In assessing the relationship between follow-up and demographic variables, no significant relationship was observed between complete follow-up and age (p=0.037), education (p=0.02) and insurance (p=0.021). Table 2 demonstrates frequency distribution and the relationship between demographic and socioeconomic variables with treatment and follow-up.

**Table 2.** Frequency distribution and the relationship between demographic/ socioeconomic variables and treatment/follow-up of colon cancer patients registered in Cancer Research Center of Shahid Beheshti University of Medical Sciences

| Variable | Classification | Treatment Frequency (%) | | | | Follow up Frequency (%) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Incomplete | Complete | $x^2$ | P value | Incomplete | Complete | $x^2$ | P value |
| Age | <60 | 10(5.2) | 185(94.8) | 9.939 | *0.002 | 25(12) | 170(88) | 3.565 | 0.037* |
| | >60 | 53(16.1) | 271(83.9) | | | 64(19.5) | 260(80.5) | | |
| Sex | female | 22(8.6) | 215(91.4) | 2.273 | 0.034* | 36(14.7) | 201(85.3) | 4.199 | 0.235 |
| | male | 44(14.9) | 239(85.1) | | | 53(18.5) | 230(81.5) | | |
| Marital status | single | 2(9.5) | 19(90.5) | 2.273 | 0.321 | 5(23.8) | 16(76.2) | 4.199 | 0.123 |
| | married | 12(2.5) | 468(97.5) | | | 40(8.4) | 440(91.6) | | |
| | divorced | 0(0)+ | 14(100) | | | 0(0)+ | 14(100) | | |
| Education | illiterate | 12(15.4) | 66(84.6) | 2.162 | 0.339 | 20(25.6) | 58(74.4) | 7.776 | *0.020 |
| | diploma and less | 43(11.8) | 311 (88.2) | | | 56(15.2) | 298(74.8) | | |
| | academic | 10(11.4) | 78(88.6) | | | 13(14.8) | 75(85.2) | | |
| Income (toman) | 0 | 18(8.5) | 185(91.5) | 4.889 | 0.180 | 31(15) | 172(85) | 0.696 | 0.874 |
| | <500,000 | 18(14.0) | 112(86.0) | | | 22(17.1) | 108(82.9) | | |
| | 500,000-1000,000 | 25(16.3) | 123(83.7) | | | 27(18.4) | 121(81.6) | | |
| | >1,000,000 | 3(7.9) | 35(92.1) | | | 7(18.4) | 31(81.6) | | |
| Occupation | employed | 19(15) | 104(85) | 4.652 | 0.199 | 25(20.0) | 98(80) | 3.695 | 0.296 |
| | unemployed | 0(0)+ | 10(100) | | | 0(0)+ | 10(100) | | |
| | retired | 26(13.5) | 167(86.5) | | | 31(16.1) | 162(83.9) | | |
| | housewives | 18(9.3) | 176(90.7) | | | 32(16) | 162(84) | | |
| Insurance | No | 4(12.5) | 28(87.5) | 0.244 | 0.622 | 9(28.1) | 23(71.9) | 5.340 | *0.021 |
| | Yes | 59(12.1) | 426(87.9) | | | 79(16) | 406(84.0) | | |

*Cells labeled show statistically significant at p<0.05

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Multivariate logistic regression test (the forward Wald method used a variable entry p-value of 0.05 and a removal p-value of 0.10) was used to determine concurrent effects of variables on treatment and follow up. All demographic and socioeconomic factors were included in the model for treatment. The Odds Ratio (OR) of completing treatment for patients under 60 years of age versus patients above 60 years was 3.13 (95% C.I. 1.55 to 6.34) and the OR of completing treatment for women versus men was 1.91 (95% C.I. 1.33 to 2.74). The results of logistic regression for treatment are shown in table 3.

All demographic and socioeconomic factors were included in the model for follow-up as well. The OR of cancer follow up in illiterate patients versus college-educated patients was 0.45 (95% C.I. 0.24 to 0.82), and the OR of cancer follow up in patients without insurance versus patients with insurance was 0.46 (95% C.I. 0.21 to 0.98).

The results of logistic regression for follow up are demonstrated in table 4.

## Discussion

The aim of this study was to assess the relationship between socioeconomic status and demographic

**Table 3.** Logistic regression test results in relationship between demographic/socioeconomic variables and complete treatment of colon cancer in patients registered in Cancer Research Center of Shahid Beheshti University of Medical Sciences

| Treatment | variable | β | S.E. | Sig. | OR | 95% C.I. for OR | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Model | Gender | .648 | .285 | .023 | 1.912 | 1.33 | 2.749 |
| | Age | 1.144 | .358 | .001 | 3.139 | 1.553 | 6.342 |
| | Constant Coef. | 1.499 | .181 | .000 | 4.479 | - | - |

**Table 4.** Logistic regression test results in relationship between demographic/socioeconomic variables and complete follow up of colon cancer in patient registered in Cancer Research Center of Shahid Beheshti University of Medical Sciences

| Follow Up | variable | β | S.E. | Sig. | OR | 95% C.I. for OR | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Model | insurance | -.776 | .389 | .046 | .460 | 0.215 | 0.986 |
| | education | | | | | | |
| | illiterate | -.791 | .307 | .010 | .453 | 0.248 | 0.828 |
| | ≤ diploma | -.204 | .266 | .444 | .816 | 0.484 | 1.374 |
| | Constant Coef. | 1.930 | .187 | .000 | - | - | - |

factors with treatment and follow-up of colon cancer in patients registered in Cancer Center of Shahid Beheshti University of Medical Sciences. According to the results, no significant correlation was observed between ageless than 60 years and female sex with complete treatment. Further, no significant correlation was found between academic education and having insurance with complete follow-up after treatment of colon cancer (p<0.05). However, no significant correlation was found between marital status, job type, income and treatment type with complete treatment and follow-up of colon cancer (p>0.05).

In this study, age was an important determining factor in completing treatment. Comorbidities, disabilities, and financial limitations may affect patient's ability to tolerate intensive curative treatment and follow up in older ages. Therefore, these limitations could decrease the quality of cancer treatment and follow-up in old patients. Other studies showed a strong relationship between increase in age and decrease in quality of treatment and follow-up for either colorectal cancer or other cancers; these studies confirm our results [13-15]. Faivre-Finn study revealed that surgical treatment of colon cancer in people below 75 years of age was 3.18 times higher than people older than 75[16]. In another study, Potosky indicated that use of standard treatment was 78% for those younger than 55 years and 24% for those older than 80 years with colon cancer [17]. Also, Cooper found that age at diagnosis was the strongest determinant of chemotherapy: 78% of patients aged 65-69 years, 58% of those aged 75-79 years, and 11% of those aged 85-89 years received postoperative chemotherapy in treatment of colon cancer and treatment rates declined dramatically with chronologic age [18] which confirms the results of this study. Another correlated factor in complete treatment is gender. This study shows that women complete their treatment more than men. There were controversy and difference in results of other studies. Some studies found equal results for men and women [19, 20]; but in Roetzheim study it was indicated that women received surgical treatment more than men (OR_1.18; 95% CI _ 1.02 to 1.37) [21]. Higher rate of treatment completion in women than men may be one of the causes for difference in the survival rate between men and women. In Harmon study, after adjusting for age and underlying diseases, women had lower risk of death after treatment of colon cancer than men (RR=0.75, p<0.01) [22]; and in Dayal study, Overall Survival (OS) for colon cancer was higher in women [23].

In this study, there was a direct correlation between education and 5-year follow-up.

Formal education is usually completed in young adulthood, and therefore captures the long-term influences of adult health and adult resources (for example employment status and income).

Educated people have sufficient knowledge and skills for receiving health messages at the right time and have more competencies for accessing health services [24] though they know the importance and necessity of follow-up. In one study, Albano showed that mortality rate for colon cancer in people with less than 8 years of education was 2.2 times higher than those who had 17 years of education or more [25]. In Ciccone study, it was found that the lower the education (<9 year), the more time between symptoms onset and surgical treatment [26] which confirms the results of this study. Insurance did not correlate with complete treatment but it correlated with regular follow-up. The time for treatment process of cancer is short but follow-up is a long-time process, so having insurance affects the follow-up process rather than treatment. There are different results about insurance and colon cancer outcomes in various studies. Roetzheim et al. found that patients who were uninsured or insured by Medicaid had higher mortality rate (after adjusting for age, gender, stage on diagnosis, treatment, co morbidities, marriage status, smoking and socioeconomic level) [21]. Ward also found that those who were uninsured or insured by Medicaid had 1.6 times higher mortality rate in a 5-year follow-up than people with private insurance, and this may be the result of a variety of factors related to access to care, differences in tumor size, grade, delays in initiation of treatment, differences in receiving treatment consistent with recommended guidelines, quality and outcome of specific treatments, such as completeness of surgical resection, differences in provision of supportive care and completion of the full course of therapy [27].

Although there were no relationship between income with treatment and follow-up, income had an impaction the treatment process in other studies. In Gorey study, a direct relationship was observed between income and colon cancer survival [28].In another study, Elston Lafata indicated that the likelihood of follow-up increased with increase in income (RR = 1.09, p= 0.03) [29].

There were some limitations in the study. The information on dead patients may not be considered complete as it was obtained from their family. Also, recall bias may have occurred during this process as the information belonged to the last 5 years of the patients' life.

## Conclusion
Education is one of the symbols of socioeconomic status and has great effects not only on disease diagnosis through affecting screening and accessing health care centers, but also on survival of patients by affecting follow-up. Further studies are recommended to assess the correlation of socioeconomic status, in detail, with cancer follow ups after treatment. According to the previous studies and the results of this study, old age is a strong predictive factor for treatment of cancer. It seems that precise recognition of these differences and performing effective interventions to improve treatment and follow up for old patients is of prime importance. Considering the role of regular follow-up for increasing the survival rate of patients with colon cancer, and its direct relationship with having insurance, it seems that increasing the insurance contribution in follow up measures may lead to increase in the regular follow up and may affect patients' survival.

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## Conflict of Interest
The authors have no conflict of interest in this article.

## Authors' Contribution
Hamid Reza Hosseini collected the data and Farzane Ahmadi analysed it. Efat Davoudi revised and edited the manuscript.

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