

Analysis of Patterns of Pharmaceutical Use in Manitoba, 1996: Key Findings

A POPULIS Project

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The Manitoba Centre for Health Policy and Evaluation

The Manitoba Centre for Health Policy and Evaluation (MCHPE) is a unit within the Department of Community Health Sciences, Faculty of Medicine, University of Manitoba. MCHPE is active in health services research, evaluation and policy analysis, concentrating on using the Manitoba health data base to describe and explain patterns of care and profiles of health and illness.

Manitoba has one of the most complete, well-organized and useful health data bases in North America. The data base provides a comprehensive, longitudinal, population-based administrative record of health care use in the province.

Members of MCHPE consult extensively with government officials, health care administrators, and clinicians to develop a research agenda that is topical and relevant. This strength, along with its rigorous academic standards and its exceptional data base, uniquely position MCHPE to contribute to improvements in the health policy process.

MCHPE undertakes several major research projects, such as this one, every year under contract to Manitoba Health. In addition, MCHPE researchers secure major funding through the competitive grants process. Widely published and internationally recognized, they collaborate with a number of highly respected scientists from Canada, the United States and Europe.

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EXECUTIVE SUMMARY

Introduction

Until recently, researchers at the Manitoba Centre for Health Policy and Evaluation (MCHPE) were missing data on an essential component in the description of the use of health services by Manitoba residents: pharmaceutical use. Using 1996 data from Manitoba Health's Drug Programs Information Network (DPIN), we have moved MCHPE's Population-Based Health Information System (POPULIS) closer to understanding, more completely, Manitoba residents' use of health care resources including their use of pharmaceuticals.

Our primary finding is that Manitobans' use of pharmaceuticals appears to respond to the population's need for prescription drugs. In other words, we have found in examining DPIN data that there is a pattern of differential response to different levels of population need. For example, we found that the regions with the highest use of pharmaceuticals were also those areas whose residents had the poorest health (as judged by rates of death among those 0-74 years of age) and the highest level of socioeconomic risk.

Methods

The first pharmaceutical use module of POPULIS examines three major themes: access to pharmaceuticals, intensity of use of pharmaceuticals, and expenditures on pharmaceuticals for all drug classes and for specific classes of pharmaceuticals. In addition, several different perspectives are used to describe Manitoba residents' use of pharmaceuticals. Description of pharmaceutical use was made possible by using the administrative prescription claims data found on Manitoba Health's Drug Programs Information Network for virtually all Manitobans.

First, pharmaceutical use was summarized. We examined factors such as the proportion of the population using pharmaceuticals (our definition of access), the age and sex of persons

using pharmaceuticals, the types and numbers of different pharmaceuticals used and the amount spent on pharmaceuticals on a per resident and per pharmaceutical user¹ basis. Secondly, pharmaceutical use received by Winnipeg residents is compared with pharmaceutical use received by individuals who reside in other areas of the province (non-Winnipeg). Finally, the analysis focuses on comparing pharmaceutical use received by residents in each of the Manitoba Rural Health regions and nine Winnipeg areas and by different socioeconomic characteristics (in Winnipeg).

In addition to obtaining a baseline of pharmaceutical use by all residents we also set out to add to the methodological techniques already used to describe pharmaceutical use in a population-wide context. Before completing the analyses, however, a myriad of technical issues such as completeness of data, validity of data and copayment rates had to be resolved and understood.

Findings

- **Use of Pharmaceuticals in Manitoba, 1996**

Individuals and agencies responsible for paying for out-of-hospital pharmaceutical use in Manitoba paid \$187.6 million in 1996 (a 2.8% increase over calendar year 1995 using the same data source). Pharmaceutical use is primarily described through the prescription claims to the Drug Programs Information Network (DPIN) by pharmacists. Prescription claims are comprised of two components: ingredient price of drug and professional fee for dispensing. In 1996, ingredient cost accounted for \$144.3 million of total cost (a 3.0% increase over 1995). Professional fees for dispensing are approximately 23% of total costs of pharmaceutical use in Manitoba.

At least one prescription was dispensed to 66.4% of the residents of Manitoba in 1996. A pharmaceutical “user” is a person dispensed at least one prescription in a calendar or fiscal year. The mean number of prescriptions dispensed per resident was 5.9 and the mean number of prescriptions dispensed per pharmaceutical user was 8.9.

¹ ‘Pharmaceutical user’ is a person who has had at least one prescription drug dispensed in a year (1996).

The mean expenditure per prescription was \$ 27.14 in 1995 and \$ 27.96 in 1996 (an increase of 3% over 1995). Total expenditures for pharmaceuticals per resident and user were \$164.86 and \$248.54, respectively. The most commonly dispensed group of drugs to residents of Manitoba were drugs which act on the nervous system (ATC=N): 1274 prescriptions dispensed per 1000 residents in 1996.

- **Pharmaceutical Use Patterns of Winnipeg vs. Non-Winnipeg Residents**

Given what appears to be very different availability of health care services available to Winnipeg versus non-Winnipeg residents, one might expect differential use of pharmaceuticals. That is, with 91.7% of specialist physicians practicing in Winnipeg and most of the tertiary care delivered there (see Roos et al., 1999) one might be concerned about non-Winnipeg residents access to pharmaceuticals, given their residence outside this centre. However, at least as judged by overall rates of access and expenditures, there is little difference in residents' use of pharmaceuticals, regardless of where they live.

- **Pharmaceutical Use by Health and Health Risk Characteristics of Area Residents**

Healthy people generally use less health care than do those who are unhealthy. Since no single measure has been developed to identify the health status of residents of a particular area, we use premature mortality (death before age 75) as an indicator of the general health of a population. The proportion of the population that uses at least one prescription per year by region, ordered by premature mortality rate (PMR), differs little among regions despite an approximate 20% under-reporting rate in northern areas served by nursing stations (e.g., Burntwood, Norman).

Areas of the province where health is generally poorer have more numbers of prescriptions dispensed. In the healthiest area of the province, Winnipeg southwest, 5.2 prescriptions per resident were dispensed in 1996; whereas, in Winnipeg's inner core area, the least healthy region of the province, 8.9 prescriptions per resident were dispensed accounting for a 71% difference between the two extremes. Expenditures

per resident per year by region also tend to increase as one moves from the healthier regions to less healthy regions of the province.

- **Pharmaceutical Use by Socio-economic characteristics of Residents**

In previous work (Roos and Mustard, 1997) we have compared the health and health care use patterns of Winnipeg residents according to the average household income in their neighborhood of residence. There was a marked difference in health status as measured by age/sex standardized death rates across the Winnipeg population. Individuals in middle-income neighborhoods (Quintile 3) have higher mortality rates than individuals in the highest-income neighborhoods (Quintile 5), while those in the poorest neighborhoods demonstrated the highest rates.²

Higher use of pharmaceuticals is also found in the lower income groups which are found to have the poorest health status. That is, the higher the income group, the lower the proportion of users, the fewer numbers of prescriptions dispensed per resident and per user, the less intense the use by type of drug and the lower the expenditure per resident and user. There is one exception: drug expenditure for the highest income group neighbourhood is higher than that for the 20% of the population who live in the next highest income neighborhood.

Discussion

This module of POPULIS was designed to describe patterns of pharmaceutical use and expenditures by Manitoba residents, and is not intended to explain the different patterns. The data do allow us, however, to raise legitimate questions about the use of pharmaceuticals and further research will be required to address them:

² Income quintiles are geographic area measures of socioeconomic status derived from Canadian 1991 Census data. Census-derived household income data, aggregated to the geographic unit of the enumeration area, were used to rank neighborhoods by average household income (Mustard & Roos, 1994; Wilkins 1993; Krieger 1992). The top 20% of the population by mean neighborhood household income is identified as Quintile 5 and the poorest 20% as Quintile 1.

Access: How does access to pharmaceutical agents vary across the population? Do healthier populations have access to more or to different drugs? How do these patterns vary for individuals who have defined morbidity (i.e., diabetes, hypertension, etc.) according to geographic location or socioeconomic standing? To what extent do physician practice characteristics influence these patterns?

Intensity: To what extent do different populations appear to receive levels of medication that are higher or lower than one would expect, given standard uses of the medications? What factors would explain differences in drug intensity?

Quality: For key indicator conditions, what percent of the population receives potentially appropriate pharmaceuticals in appropriate doses? How does this vary by population characteristics (e.g., geography, SES status)?

System Use: How do populations who appear to receive optimal drug therapy use other sectors of the health care system? Are there lower rates of hospitalization? How do populations with patterns of potentially inappropriate drug therapy use the health care system?

1. INTRODUCTION

1.1 Population Health Information System (POPULIS)

In January, 1991, the Manitoba Centre for Health Policy and Evaluation (MCHPE) was established at the University of Manitoba to provide Manitoba Health with research-based analysis, evaluation and identification of policy options. The researchers agreed to undertake several specific projects each year as well as to develop a health information system for the province.

The Population Health Information System (POPULIS) is designed to focus on the link between health care utilization and health, to make it possible to examine how effectively and efficiently a health care system produces (or fails to produce) health across various regions of the Province. We have attempted to develop an information system that supports rational decision-making and that ultimately shifts discussions from a focus on the demand for health care to a demand for health. The system is population-based, designed to track the health status and health care use of residents of all regions regardless of where such use takes place, an approach that is distinct from examining patterns of care delivered by specific providers or facilities.

The pharmaceutical use module is one of several different modules being created as a part of the POPULIS:

Population Health: Health Status Indicators - Released January 1994

Socioeconomic Status of Health - Released January 1994

Utilization of Personal Care Homes - Released October 1993

Utilization of Hospital Resources - Released January 1994

Utilization of Physician Resources - Released March 1994

1.2 Pharmaceutical Use Module

The pharmaceutical use module of the Population Health Information System focuses on describing Manitoba residents' use of pharmaceuticals. This report examines measures of access to pharmaceuticals, intensity of use of pharmaceuticals (using several measures, such as number of prescriptions, number of different drugs), and expenditures for pharmaceuticals. Separate analyses are presented for different classes of pharmaceuticals and use is described by age/sex, region and income quintile.

The addition of pharmaceutical data to POPULIS, in 1995, fills a key missing piece in the Centre's ability to analyze the population's use of health care and the relationship between health care expenditures and health. Pharmaceuticals now make up 3% of the Manitoba government's expenditure on health care, roughly equivalent to what it spent on home care in 1996. However, total pharmaceutical expenditures (as summed over a combination of payment by government agencies, private insurance benefits and out-of-pocket dollars) are the fastest growing component of health care expenditures, representing 12.7% of total expenditures on health care goods and services in 1994 (Health Canada, 1996). The ability to study population-based patterns of pharmaceutical use adds an important dimension to POPULIS and provides a more comprehensive understanding of how the population uses the mix of health care services. It allows us to ask, for instance:

- Do healthy populations use more or less pharmaceutical agents than less healthy populations? Does this vary by type of agent? (These questions are the focus for this module's analyses.)
- For populations with equivalent health status, is there evidence that higher expenditures on pharmaceuticals are associated with lower expenditures for hospital and/or physician services? (i.e., is there evidence of substitutability across sectors of care?) Or alternatively, are higher population-based patterns of use of pharmaceutical agents associated with higher intensity of use of physician and hospital care?

- Which patterns of pharmaceutical use are associated with good health outcomes at the population level?

2. METHODS

2.1 Analytic Approach

The major focus of this module of POPULIS is on describing the pattern of pharmaceutical use by Manitobans. These analyses do not focus on physician prescribing patterns, rather they describe the pattern of pharmaceutical use by the population living in defined areas, whether the pharmaceutical is dispensed in or out of the region of residence. For example, a prescription dispensed to a resident of Brandon in Winnipeg is counted in Brandon residents' utilization rates. Although the analyses as presented raise many questions regarding regional differences in utilization, little attempt is made in this report to answer them: we simply seek to accurately describe the use of pharmaceuticals. Also, since data are presented without information about tests of significance or confidence intervals, caution must be used in interpreting results.³

The analyses are based on dispensed prescription claims submitted to Manitoba Health by 286 dispensaries providing pharmaceuticals to Manitoba residents for the calendar year 1996. Residents of Manitoba were identified and information about their current region of residence was obtained from the Manitoba Health registry file. Residence information on the registry file may not be reliable for Status Indians⁴ because Manitoba Health assigns the region of residence as the First Nation of Origin, usually a municipality denoted as an Indian Reserve. For some of these residents, however, postal code information taken from the individual's first pharmaceutical claim was needed to assign region of residence.

The numerator for rates was calculated by counting or adding individuals, prescription claims, number of different drugs, defined daily doses (DDD) and expenditures during the

³ From a statistical perspective, because the findings are based on the analyses of information from all people in the population (instead of a sample, which represents information from only part of the population), they are not subject to sampling variability (Satin and Shasty, 1986).

⁴ The designation "Status Indians", also referred to as "Treaty Indians", refers to a specific group of the aboriginal population that has certain rights and privileges under the Indian Act of Canada. Not all Status Indians are recorded as such on the Manitoba Health registry.

year for individuals according to their area of residence. Denominators were based on counts of individual residents in one of 11 rural regions or 9 urban (Winnipeg) areas as per the population registry information of December 31, 1996. Because this report focusses on populations, we report usage according to the area of an individual's residence, not according to the site where the medication was purchased.

In addition to crude rates, age- and sex-adjusted rates of indicators were developed to permit comparisons across regions. The age and sex structure of the population, together with differing needs for health care, are factors recognized as contributing to different regional requirements for pharmaceuticals, and accordingly are factors that ultimately influence the pharmaceuticals dispensed. Rates are age- and sex-adjusted using Manitoba population proportions for the year of analysis and a direct method of standardization. These mathematically adjusted rates provide an indication of the expenditure and use of pharmaceuticals in one region relative to use in another, after the effects of differing population structures have been removed.

2.2 Conceptual Issues

General direction for the types of concepts needed to describe the population's use of pharmaceuticals--a measure of access (percent of population dispensed one or more prescriptions during the year), measures of intensity of use and a measure of expenditures--was provided by the concepts developed to study other data sets in POPULIS.

As with any first time use of data, much effort was devoted to assessing validity and reliability issues. The tests included comparisons with pharmacists' records [as part of a masters thesis by one of the authors (AK)], comparisons with published findings in the literature, and a year to year comparison (1995 to 1996) after a year of major policy change. (A new cost-sharing policy including a much steeper income-based deductible was introduced after DPIN's first year of operation; and, there was a concern that those groups

with the largest deductibles might refuse to participate in the system.) The results of the validity checks were encouraging, and except for some underreporting in a small number of identifiable groups, the data seem robust.

In summary, this study was designed to obtain a baseline of pharmaceutical use by all Manitobans and to add to the methodological techniques already used to describe pharmaceutical use in a population-wide context. Before completing the analyses, however, a myriad of technical issues such as completeness of data, validity of data and copayment rates had to be resolved and understood.

2.21 Manitoba Population

Pharmaceutical drug use was examined for 1.14 million Manitoba residents including those who died or were born during the respective study year (1996). Manitoba residents not covered by this analysis include federal penitentiary inmates and some Status Indians. Population counts are based on the Manitoba Health registry as of December 31, 1996.

2.22 Time Period Covered

Figures and tables in this report are based on pharmaceuticals dispensed during the calendar year beginning January 1, 1996, through to December 31, 1996.

2.23 Completeness of Data

For this analysis, we used data from the Drug Programs Information Network (DPIN). DPIN is an administrative claims database of prescriptions dispensed for out of hospital usage by Manitoba residents. It also includes most prescriptions for outpatient use dispensed by hospitals. DPIN is administered through real-time computer links with every community-based pharmacy in the province and is maintained by the Ministry of Health.

The provincial government provides some funding of pharmaceuticals for the majority of the Manitoba population through Pharmacare; this population files 85% of the total claims. Claims from Pharmacare recipients represent the following segments of the Manitoba population: nursing home residents (300,699 claims or 4.5% of total claims); Manitoba

Family Services (a program available to all families requiring social assistance and not covered by Winnipeg social services) recipients, (494,170 claims or 7.4% of total claims); and for all Manitobans not covered by any of the previously-described programs (4,910,697 claims or 73.1% of total claims). These prescription claims are adjudicated for presence of complete prescription data, inappropriate prescribing (e.g., a dose outside acceptable guidelines or a drug interaction with an existing therapy) and a maximally accepted ingredient price. For the remaining proportion of the population not covered by Pharmacare (Status Indians and Winnipeg social service recipients), prescription data are captured by DPIN when prescriptions are submitted to the DPIN program by the dispensing pharmacy in order to screen for possible inappropriate use (e.g., drug-drug interactions). The degree of financial responsibility that government has for each prescription claim has an impact on the amount of data available for analysis from each claim. For the majority of claims (80.5% - that is those covered by Pharmacare but not including nursing home), the data extracted from each claim includes: a person-specific identifier (a scrambled version of the personal health identification number) linkable to region of residence, sex, date of birth; physician and pharmacy identifiers; the date the prescription claim was dispensed; metric quantity of drug dispensed; drug (product) identification number (DIN); dosage form (tablet, capsule); strength (in milligrams, grams, etc.); number of days supply; ingredient price per unit of drug (diazepam 5mg Roche \$0.1573/tablet); total ingredient price (30 x diazepam 5 mg Roche = \$4.72); professional dispensing fee charged (e.g., \$6.50 per prescription), and total expenditure for each claim (30 diazepam 5 mg Roche = \$4.72 + \$6.50 = \$11.22). There are limitations on the amount of data available from the remaining 19.5% of claims (Status Indians, Winnipeg Social Services and nursing homes). The imputation formulas that were used to overcome the data limitations can be found in Appendix I.

As well, rates used to compare pharmaceutical use and expenditures by age, sex, region and income quintile are limited to a common set of pharmaceutical products covered by all agencies (Pharmacare, Medical Services Branch [Status Indians], Winnipeg Social Services). We call this common set of pharmaceutical products a “master formulary.” A total of 3,328 drug products covered by all agencies comprised 707 discrete drug entities. Limiting the analysis to a common or “master” formulary resulted in a loss of 12.8% of total claims from

the data sets. These claims are largely comprised of over-the-counter products and non-pharmacologicals (e.g., bandages, diabetic testing agents) not generally covered by the provincial Pharmacare program.

The Anatomical Therapeutic Chemical (ATC) classification system for human medicines from WHO's Collaborating Centre for Drug Statistics Methodology (1995) was used to classify drug entities in the master formulary. This classification system divides drugs into different groups according to the organ or system on which they act and/or therapeutic and chemical characteristics (WHO 1995). The first level of the code is based on a letter for the anatomical group, e.g. "N" for nervous system; the second level of the code is the therapeutic main group, e.g., "N05" for psycholeptics (includes antipsychotics, anxiolytics, hypnotics and sedatives); and the third level of the code is the therapeutic sub group, e.g., N05 "B" for anxiolytics. There are five levels of classification in total.

Missing from the database are pharmaceuticals dispensed to Manitoba residents during treatment in a hospital and pharmaceuticals dispensed to Status Indians through nursing stations which are primarily located in the sparsely populated north of the province.

Pharmaceutical use by residents of nursing homes are included in most analyses.

Appendices I and II outline more issues that were methodically addressed in order to use these data to describe and interpret pharmaceutical use.

2.24 Validity of Data

An assessment of the data quality of the DPIN prescription database has been undertaken (Kozyrskyj 1996). Prescriptions dispensed during March 13-17, 1995 in a stratified sample of Manitoba pharmacies were linked to the DPIN database by prescription number to determine the proportion submitted for Status Indians, Winnipeg Social Services and Manitoba Family Services⁵ and Pharmacare recipients. Prescription records in DPIN were compared with original pharmacy records to evaluate data accuracy. Of 2,196 Status Indian and Winnipeg Social Services prescription records dispensed in 58 randomly chosen

⁵ Prior to August 1995, prescriptions reimbursed by Manitoba Family Services were submitted to DPIN to screen for inappropriate drug use, and not for reimbursement purposes.

pharmacies (23.5% of Manitoba pharmacies), a corresponding prescription was found in DPIN for 79.7% (95% CI: 78.0-81.4%) and 90.1% (95% CI: 88.8-91.4%) of Status Indians' and Winnipeg Social Services prescriptions respectively. These proportions were significantly lower than the estimated proportion⁶ of Pharmacare prescriptions submitted (93%, 95% CI: 92.4-93.6%). Ninety-two percent (92%) of 8,012 DPIN Pharmacare prescriptions matched the original prescription on the drug name, quantity and days supply.

2.25 Copayments for Pharmaceuticals

Prescription benefits are paid 100% by either municipal, provincial or federal government, for individuals covered by the social services agencies (Winnipeg Social Services, Manitoba Family Service and personal care home residents) or who are Status Indians. The balance of Manitoba residents have their prescription expenses covered variably by the provincial Pharmacare program. Coverage is dependent on the family making application once reaching their income-based deductible. During 1996, the year of this study, the rate at which pharmaceuticals were reimbursed by the province changed significantly, resulting in larger deductibles for most families. While the results are not reported here, enough comparisons were made to determine that there was not a major shift in aggregate usage patterns which would raise questions about the validity of the patterns of use reported here.⁷ Also, DPIN captures the claims of all dispensed prescriptions whether or not any government, private insurance benefit or consumer pays for the prescription's expense. In other words, government and private insurance benefits do not always provide us "first dollar coverage" for prescription drugs, but DPIN allows us to collect "first dollar data."

Prior to April 1, 1996 (and hence for the first 3 months of the period reviewed here), families where one member was 65 or more years of age paid an annual deductible of \$134.40; after the deductible was reached, the program reimbursed these families 70% of the total cost of

⁶ Data access restrictions precluded the enumeration of Pharmacare prescriptions dispensed in pharmacies, necessitating the use of estimation procedures to determine the proportion of pharmacy prescriptions submitted to DPIN.

⁷ Manitoba's DPIN has been in place since July 1994. Therefore, only two years of data were available for analysis. Between calendar year 1995 and calendar year 1996, expenditures for prescription drugs increased by 2.8% and numbers of prescriptions dispensed decreased by 0.16%.

each prescription dispensed. Manitoba families where all members of the family were less than 65 years of age covered by Pharmacare faced an annual deductible of \$237.10 per family for this three month period and once reached, were reimbursed 60% of the total expense of each prescription dispensed.

Effective April 1, 1996, Pharmacare programmatically changed to a reimbursement model based on annual income regardless of age. Families with an adjusted total family income⁸ of \$15,000 or less per year have an annual deductible of 2% but must pay a minimum of \$100 deductible per year. The deductible for families with a net income exceeding \$15,000 is 3% (e.g., adjusted total family income=\$40,000, deductible \$1,200/year). After the deductible is reached in all cases and once application is made, the Pharmacare program pays for 100% of eligible drug expense claims; no maximum payment for claims per year has been established.

2.26 Total Dollar Value of Services Summarized

Individuals and agencies responsible for paying for ambulatory pharmaceutical use in Manitoba paid \$187.6 million in 1996 (a 2.8% increase over calendar year 1995 using the same data source). Pharmaceutical use is primarily described through the prescription claims to the Drug Programs Information Network (DPIN) by pharmacists. Prescription claims are comprised of two components: ingredient price of drug and professional fee for dispensing. In 1996, ingredient cost accounted for \$144.3 million of total cost (a 3.0% increase over 1995). Professional fees for dispensing are approximately 23% of total costs of pharmaceutical use in Manitoba.

⁸ "Adjusted family income" is the gross family income less \$3 000 for the spouse and each dependent child under 18 years of age.

2.27 Region of Residence

This module describes the pattern of pharmaceutical use by the population of defined areas, whether the pharmaceutical is dispensed in or out of the region of residence. For example, a prescription dispensed to a resident of Brandon in Winnipeg is counted in Brandon's residents' utilization rates.

Some of the analyses are oriented to describing patterns of pharmaceutical use by rural residents in the eleven, newly defined Regional Health Authorities (RHAs): South Westman, South Eastman, Marquette, Brandon, Central, Parkland, North Eastman, Interlake, Burntwood, Churchill and Norman. However, the Manitoba government considers the city of Winnipeg, which has 56.6% of the province's population, to be one health authority. It was felt that many of the subtleties within Winnipeg would be missed if this RHA was examined as a unit. As a result, Winnipeg has been divided into nine areas that more accurately reflect the city's socioeconomic diversity: Winnipeg: Southwest, Southeast, Northwest, Northeast, Central, West, Outer Core, Old St. Boniface and Inner Core. Pharmaceutical use is described, therefore, in 20 different regions/areas, and comparisons are made between Winnipeg and non-Winnipeg regions.

2.28 Calculation of Age

The age categories were chosen to match other Centre analyses and 21 categories were used for age-standardization: 0-2, 3-4, 5-9, 10-14, 15-19, ..., 85-89, 90-94, and 95 and older. Age was calculated as of December 31, 1996, according to the birth year reported on the first prescription claim of the calendar year, 1996.

2.29 Definition of Pharmaceutical User

A pharmaceutical 'user' is defined as an individual who had at least one prescription dispensed in the calendar year of analysis. "User" refers to anyone in the population who received at least one prescription and "resident" to any person in the population. Prescriptions were not designated as new or refill (repeat) prescriptions.

2.3 Measures of Pharmaceutical Use

For describing a population's use of the health care system we require indicators of access to pharmaceuticals, intensity of use by residents and users of pharmaceuticals and total expenditures by residents and users. The latter two measures are typically calculated using both pharmaceutical users and the population as denominators.

Access to care. In other modules of the POPULIS system we have documented the percent of the population hospitalized, the percent of the population making at least one contact with a physician during the year, and the percent of the population aged 75 years and older resident in nursing homes. In the case of pharmaceuticals, access is defined in a similar way, as the rate of individuals who receive at least one prescription during the year.

Intensity of use. Different measures of intensity have been used in quantifying intensity of drug use across populations, with number of prescriptions dispensed, defined daily doses (DDDs) and number of different drugs taken being three of the most common.

The defined daily dose (DDD) is a technical unit of measurement that was developed to overcome the limitations behind simply counting prescriptions.⁹ It standardizes the measurement of drug utilization within and between drug entities and can be used to describe drug utilization across a population. The DDD is the average dose per day for a drug product used for its major indication in everyday practice. When the number of DDDs dispensed to the population is calculated it provides a rough estimate of the proportion of the population receiving the drug at the accepted daily dose for the drug's major indication. For example, if 21.9 million doses of 0.6gram/tablet potassium chloride (KCl) are dispensed in a year to a population of one million persons, and the DDD is 3.0 gram of KCl per day, then the number of persons estimated to be using KCl is 12 per 1000 population.

⁹ Several other measures of intensity have also been developed, including prescribed daily dose (PDD). These measures in general confer no benefits when used for population-based analysis. Most have been used in studies of particular drugs and do not support summing across drug categories to estimate the total burden of drug exposure (Merlo et al. 1996). DDD was therefore closer as the primary indicator of intensity of use.

How does one derive this number? In a population-based pharmaceutical claims data base, count the number of oral doses of KCl dispensed. Since all claims for KCl in this database have a strength per tablet of 0.6 grams, to calculate the DDD equivalent of 3.0 grams of KCl per day, one first needs to divide the total number of oral tablets of 0.6grams KCl by 5 (3.0 grams DDD = 0.6 grams/tablet x 5 tablets). Based on this calculation, 4.38 million DDDs are dispensed every year to the population. To arrive at an estimate of the proportion of the population receiving the drug at the recommended daily dose, one divides the 4.38 million DDDs by 365 (days/year) and expresses the rate per 1000 population (4.38 million DDDs / year ÷ 365 days/ year = 12000 DDDs/1 million population/day or 12 DDDs/1000 population [or residents]/day).

Number of prescriptions dispensed or written (prescription volume) is problematic as a measure of intensity because the quantity of prescription items varies from prescription to prescription [enalapril 20 mg x 30 tablets vs. enalapril 20 mg x 60 tablets--both are counted as one prescription yet the second contains twice the amount of drug] and the supply per prescription can be for any time period [enalapril 20 mg x 30 tablets, use one tablet daily (30 days supply) vs. enalapril 20 mg x 120 tablets, use two tablets once daily (60 days supply)] .

Two basic assumptions underlie the use of the DDD measure: first, that patients take the medication (i.e., that patients adhere to the instructions for use); and second, that the doses used for the major indication are the average maintenance doses. The primary advantage to using a standardized measure to describe pharmaceutical use in a population is its ability to examine relative therapeutic intensity within and across various groups of drugs. The defined daily dose per person per day can be calculated using the population as a denominator as well as using those prescribed at least one drug (the ‘users’) as the denominator.

Inconsistencies in the metric quantity dispensed field, rendered non-solid dosage forms unusable for calculation of defined daily dose (DDD). A decision was subsequently made to use only solid dosage forms like tablets and capsules for the defined daily dose rate calculations. DDD analyses per year, therefore, were calculated using 79.2% of total claims.

Also, DDD analyses per day do not include personal care home (PCH) claims as the “days supply” variable is not present in this dataset; this limited the DDD per day analysis to 64.6% of total claims.

Expenditures. Another summary measure describing a population’s use of pharmaceuticals focuses on total expenditures for pharmaceuticals per resident and per user and includes the portions paid by government and by individuals. This measure will capture both a sense of the total volume of drug use plus a general indicator of the costliness of the drugs used for the entire population of Manitoba. A summary of expenditures on pharmaceuticals does not include the amount individuals spend on pharmaceuticals available without a prescription and over-the-counter.

2.31 Types of Rates Calculated

Rates are age- and sex- adjusted using Manitoba population proportions for the year of analysis and a direct method of standardization. These mathematically adjusted rates provide an indication of the expenditures and use of pharmaceuticals in one region relative to use in another, after the effects of differing population structures have been removed.

Proportion of residents who are pharmaceutical users indicates the proportion of residents who had at least one dispensed prescription per year (i.e., an individual who had one or more prescriptions dispensed is counted once, regardless of the total number of prescriptions dispensed). This measure provides a useful indicator of access to pharmaceuticals. Access is operationally defined as the proportion of residents who had at least one prescription drug dispensed in a specific calendar year.

Intensity of pharmaceutical use: Number of prescriptions dispensed is the number of prescriptions dispensed per resident and per pharmaceutical user. The fourth level of the ATC code (e.g., “C 08 C A--dihydropyridine derivatives, selective calcium channel blockers with mainly vascular effects” versus the fifth level ATC: “C 08 C A 05--nifedipine”) is used to count the *number of different drugs* dispensed per resident and per pharmaceutical user.

Six defined daily dose (DDD) rate calculations can be used to measure various aspects of intensity: number of DDDs used per day per resident and per user, number of DDDs used per year per resident and per user, and number of DDDs used per prescribed day per resident and per user. The number of DDDs used per day per resident provides a rough estimate of the proportion of the population treated daily with a specific drug (e.g., methylphenidate) or groups of drugs (e.g., antiinfective). The number of DDDs used per prescribed day per user should equal one (=1), if the drug being examined is primarily used for its main indication at its recommended dose. To the extent that the number of DDDs used per prescribed day per user is above or below one could indicate that the drug is being used primarily for a different indication at a different dose or that the drug is being underdosed for its main indication.

The number of DDDs used per year per resident is equivalent to estimating how many days of treatment every resident, if placed on the drug, would have consumed in a year. The number of DDDs used per year per user is equivalent to the average duration of treatment (number of days per year) for every user of the drug or drug class. Not all six DDD rates are reported in this paper.

Expenditures for pharmaceuticals is the amount paid either by government agency and/or individual for the drug ingredient, professional fee and total prescription per resident or per pharmaceutical user.

3. KEY FINDINGS

With the exception of the defined daily dose rate calculations, population-based measures of pharmaceutical use in Manitoba are based on the dispensing of 6,709,997 prescriptions for calendar year 1996. For the intensity of pharmaceutical use measure using the defined daily dose (DDD), only single-entity, oral solid dosage form claims are included in the rate calculations (n=4 333 002, 64.6% of total claims).

At least one prescription was dispensed to 66.4% (664 per 1000 residents) of the residents of Manitoba in 1996. The mean number of prescriptions dispensed per resident was 5.9 and the mean number of prescriptions dispensed per pharmaceutical user was 8.9 in 1996. The mean expenditure per prescription was \$ 27.14 in 1995 and \$ 27.94 in 1996 (an increase of 3% over 1995). Total expenditures for pharmaceuticals per resident and user were \$164.86 and \$248.54, respectively. Table 1 summarizes the population-based measures of pharmaceutical use using indicators of access, intensity and expenditures.

Table 1: Population-Based Measures of Pharmaceutical Use

	Residents	Users (=one or more prescriptions dispensed per year)
Users of pharmaceuticals*	66.4	n/a
Intensity of use measures:		
# prescriptions/year	5.9	8.9
# different drugs used/year	2.1	3.2
# defined daily doses (DDDs**)/day	0.4***	0.6***
Expenditures:		
per resident/year	\$164.86	\$248.54
per prescription	\$27.94	\$27.94

□ Users per 100 residents

** The defined daily dose is the assumed average maintenance dose per day for a drug used for its main indication in adults (WHO, 1995)

*** Every resident/user is dispensed the equivalent of 0.4 / 0.6 defined daily doses of medication per day. These calculations were limited to solid dosage forms.

The reader is reminded that there is an approximate 20% under-reporting rate in northern areas served by nursing stations (e.g., Burntwood, Norman).

3.1 Access to Pharmaceuticals

The age distribution of access to pharmaceuticals is slightly different for males and females, with a markedly higher likelihood of use for females beginning at age 15 and persisting to age 75 (Figure 1). The percent of Manitobans receiving at least one prescription varies from a low of 47% (males 20-24 years of age) to a high of 92% (females over 95 years of age).

3.2 Intensity of Use

The top 20 drug entities dispensed to residents of Manitoba by number of claims and representing 38.3% of total claims were: amoxicillin (333,821), codeine combinations (312,202), salbutamol inhaler (197 139), lorazepam (143,186), furosemide (128,111), levothyroxine sodium (122,456), enalapril (121,953), sulfamethoxazole/trimethoprim (121,891), erythromycin (112,839), glibenclamide (103,697), ranitidine (103,471), nifedipine (96,857), naproxen (96,820), conjugated estrogens (93,450), amitriptyline (85,684), levonorgestrel and estrogen (birth control) (82,783), glyceryl trinitrate (74,324), beclomethasone (72,987), hydrochlorothiazide and a potassium sparing agent combination (72,782), and phenoxymethylpenicillin (71,727).

The most commonly dispensed group of drugs to residents of Manitoba are drugs which act on the nervous system (ATC=N): 1,274 prescriptions dispensed per 1000 residents in 1996 (Figure 2). The next most commonly dispensed groups of drugs are the cardiovascular drugs (ATC=C) and the antiinfectives (ATC=J).

The ATC category 'N' is largely comprised, amongst others, of natural opium alkaloids (largely combinations of acetaminophen with codeine and single entity morphine), phenothiazines, benzodiazepines, selective and nonselective serotonin reuptake inhibitors. The top five drug entities in the 'N' ATC category and accounting for 43.5% of 'N' category

claims were: codeine combinations (312 202 claims), lorazepam (143 186), amitriptyline (85 684), diazepam (51 685), and alprazolam (40 935).

Figure 1: Percent Population with Access to at Least One Prescription by Age and Sex in Manitoba, 1996

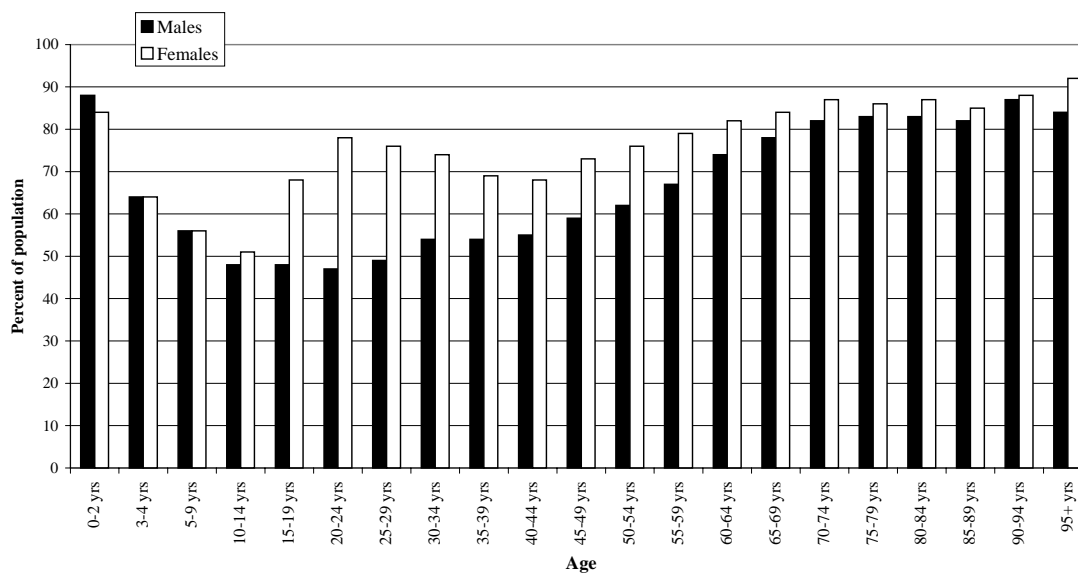
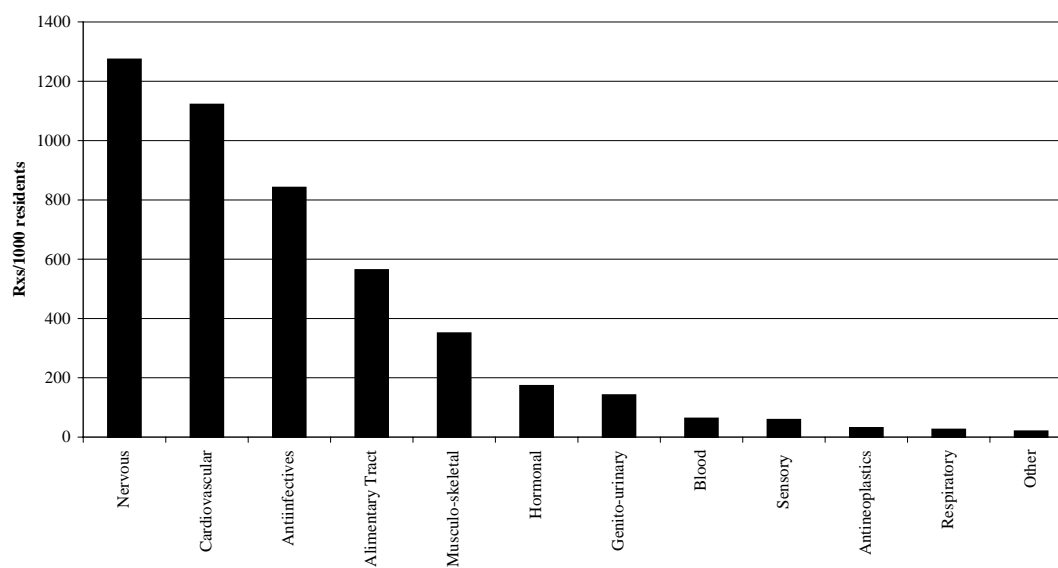


Figure 2: Frequency of Drug Classes Used (by ATC Classification) Number of Prescriptions per 1000 Residents, 1996



The next most commonly dispensed group of drugs to residents of Manitoba were drugs for the cardiovascular system (ATC=C): 1122 prescriptions dispensed per 1000 residents in 1996.

The ATC category 'C' is comprised of cardiac glycosides, antiarrhythmics, peripheral vasodilators, and antihypertensives other than diuretics, beta blocking agents, calcium channel blockers and angiotensin converting enzyme inhibitors which are also included. The top five drug entities in the 'C' ATC category and accounting for 36.1% of 'C' category claims were: furosemide (128,111), enalapril (121,953), nifedipine (96,857), glyceryl trinitrate (74,324) and hydrochlorothiazide and potassium sparing agents (72,782).

Antiinfectives were the third most commonly dispensed group of drugs. They belong to the ATC category 'J'; 863 prescriptions were dispensed per 1000 residents in 1996. The ATC category 'J' is comprised of all antiinfectives and the top five drug entities in the 'J' ATC category accounted for 70.9% of all antiinfectives dispensed. These included: amoxicillin (333 821), sulfamethoxazole and trimethoprim (121 891), erythromycin (112 839), phenoxymethylpenicillin (71 727) and cloxacillin (56 380).

Use of pharmaceuticals increases with age: 1.6 prescriptions per resident in the 10-14 age group; 4.2 prescriptions per resident in the 35-39 age group; 12 per resident in the 65-69 age group; and 18.1 in the 80-84 age group. More females are dispensed prescriptions than males: 730 females per 1000 residents vs. 594 males per 1000 residents. In terms of pharmaceutical users, this translates into 9.7 prescriptions per female user vs. 7.9 per male user per year.

The difference in numbers of prescriptions by gender is largely accounted for in the increased use of diuretics, estrogens, thyroid replacement, antiinfectives, nonsteroidal antiinflammatory drugs (NSAIDs), opioids (e.g., morphine, meperidine), and anxiolytics, hypnotic/sedatives and antidepressants by females. Specifically, females are prescribed antiinfectives 1.5 times and anxiolytics and antidepressants twice as often as males from the mid-teenage years to 65 years of age.

Table 3. Comparison of Intensity and Type of Use by Sex for Primary Use Category Drugs, 1996

Drug Class generic drug name ATC classification	DDD	PDD		DDD/ user/day		DDD/ User/year		DDD/ 1000 residents/ day	
		Males	Females	Males	Females	Males	Females	Males	Females
Oral Blood Glucose Lowering Drug									
glibenclamide (glyburide, DiaBeta®) A10BB01	0.010g	0.011	0.011	0.80	0.82	293	299	13.0	12.7
Cardiovascular Drugs									
hydrochlorothiazide (diuretic) C03AA03	0.025 g	0.030	0.029	0.76	0.76	277	276	7.4	14.9
metoprolol (β-blocker) C07AB02	0.150 g	0.105	0.106	0.48	0.48	174	176	5.4	4.6
nifedipine (calcium channel blocker) C08CA05	0.030 g	0.040	0.037	0.94	0.86	344	313	12.3	13.2
enalapril (ACE inhibitor) C09AA02	0.010 g	0.011	0.010	0.75	0.65	274	255	13.0	14.0
Antiinfectives									
amoxicillin J01CA04	1.0 g	1.3	1.2	0.04	0.04	16	16	5.0	6.9
ciprofloxacin J01MA02	1.0 g	0.86	0.76	0.04	0.03	14	10	0.6	0.5
Antidepressant									
fluoxetine N06AB03	0.020 g	0.026	0.025	0.54	0.54	196	198	2.0	4.7

Table 3 is a comparison of PDD and DDD, DDDs/user per day and per year, and DDDs/1000 residents per day by sex. DDDs/user/day should be close to the value of one if the drug is being used for its main indication at an average adult maintenance dose. The DDDs/1000 residents/day is an indication of the proportion of the population taking the drug. The disparity seen by gender for diuretics, antiinfectives and antidepressants in Table 3 is repeated in the analysis by sex (M:F/1000 residents) for corticosteroids (6.8 vs. 7.5), thyroid replacements (5.9 vs. 28.1), NSAIDs (16.1 vs. 22.7) and anxiolytics (12.5 vs. 21.4).

3.3 Expenditures

Expenditures for pharmaceuticals by age and sex follow the same trends as do the access and intensity/type of use measures. More is paid per resident and per user as one ages; and, if you are a female younger than 70, expenditures are likely to be higher than if you are a male (Table 4). Overall, on a per resident (and per user) basis, expenditures for males are \$142.19 (\$239.30) and for females \$186.88 (\$255.84).

Table 4: Pharmaceutical Expenditures per Resident for a Sample of Age and Sex Groups (1996)

Age Group	Females in dollars (Confidence Intervals)	Males in dollars (Confidence Intervals)	Ratio of Females to Males
5-9 years	30 (28, 31)	37 (35, 40)	0.81
20-24 years	103 (101, 105)	43 (40, 46)	2.40
45-49 years	210 (204, 215)	152 (148, 157)	1.38
65-69 years	419 (410, 427)	411 (402, 421)	1.02
70-74 years	477 (469, 485)	496 (485, 507)	0.96
75-79 years	485 (476, 494)	542 (528, 556)	0.89
All ages	187 (186, 188)	142 (141, 143)	1.32

3.4 Pharmaceutical Use Patterns of Winnipeg vs. Non-Winnipeg Residents

Given what appears to be very different availability of health care services available to Winnipeg versus non-Winnipeg residents, one might expect differential access to pharmaceuticals. That is, with 91.7% of specialist physicians practicing in Winnipeg and most of the tertiary care delivered there (see Roos et al., 1998) one might be concerned about non-Winnipeg residents' access to pharmaceuticals, given their residence outside this centre. However, at least as judged by overall rates of access and expenditures, there is little difference in Manitoba residents' use of pharmaceuticals, regardless of where they live (Table 5). The proportion of users and intensity of drug use (as measured by DDDs/1000 residents/day) did differ by place residence (Winnipeg vs. Non-Winnipeg) but not in a consistent direction.

Table 5: Winnipeg vs. Non-Winnipeg Residents: Measures of Pharmaceutical Use, 1996

	Winnipeg residents	Non-Winnipeg Residents	Ratio: Winnipeg to Non-Winnipeg
<i>Access to pharmaceuticals</i>	68.1	64.8	1.05
<i>Intensity of use measures:</i>			
# prescriptions/year	5.9	5.8	1.02
# different drugs/used/year	2.0	2.2	0.91
<i># DDDs/day:</i>			
Oral blood glucose lowering	17.0	17.9	0.95
Diuretics	30.7	33.9	0.91
Beta-blocking agents	18.0	15.8	1.14
Calcium channel blockers	25.9	25.0	1.04
ACE inhibitors	31.6	35.9	0.88
Antiinfectives	16.6	15.5	1.07
Antidepressants	28.2	20.7	1.36
<i>Expenditures:</i>			
per year	\$167.57	\$161.17	1.04
per prescriptions	\$28.40	\$27.79	1.02

3.5 Pharmaceutical Use by Health and Health Risk Characteristics of Area Residents

Healthy people generally also use less health care than unhealthy people. Since no single measure has been developed to identify the health status of residents of a particular area, we have followed others in using premature mortality (death before age 75) as an indicator of the general health of a population (Carstairs, Morris 1991; Eyles, Birch, Chambers et al. 1993). Figure 3 shows premature mortality rates as annual averages in Manitoba, using five years of data from 1990 to 1994. In Roos et al., (“Managing Health Services: How Administrative Data and Population Based Analyses can Focus the Agenda, Medical Care Supplement, June 1999), populations with a high premature mortality rate have been found to be unhealthy using a variety of other objective and subjective indicators.

In rural Manitoba, the areas represent the province’s newly defined Regional Health Authorities (RHAs). Although Winnipeg with 56.6% of the population is one health authority, it has been divided into nine areas that more accurately reflected the city’s socioeconomic diversity. All subsequent figures describing pharmaceutical use by residents of different areas of Manitoba are ordered according to area residents’ premature mortality rate: with those areas on the left being identified as having the healthiest residents and those on the right the least healthy.

Figure 4 shows the proportion of the population that uses at least one prescription per year by region ordered by premature mortality rate (PMR). The reader is reminded that there is an approximate 20% under-reporting rate in northern areas served by nursing stations (e.g., Burntwood, Norman). In spite of this, however, areas of the province where health is generally poorer have more numbers of prescriptions dispensed. Note that in the healthiest area of the province, Winnipeg southwest, 5.2 prescriptions per resident were dispensed in 1996; whereas, in Winnipeg inner core, the least healthy region of the province, 8.9 prescriptions per resident were dispensed (Figure 13).

Expenditures per resident per year by region also tend to increase as one moves from the healthier regions to less healthier regions of the province (Figure 5). The proportion of the population using different drugs also shows this same upward trend (Figure 6 and Figure 7) in some classes of drugs. Use of ACE inhibitors and use of antidiabetic drugs appear to move parallel to one another. This is expected because ACE inhibitors are used in diabetics to decrease the rate of progression of diabetic nephropathy. The upward trend is seen because diabetes is more prevalent in the less healthy regions of the province. The trends for diuretic and antidepressant use appear quite flat and not associated with premature mortality rate.

3.6 Pharmaceutical Use by Socio-economic Characteristics of Residents

In previous work (Roos and Mustard, 1997) we have compared the health and health care use patterns of Winnipeg residents according to the average household income in their neighborhood of residence. There was a marked difference in health status as measured by age/sex standardized death rates across the Winnipeg population. Individuals in middle-income neighborhoods (Quintile 3) have higher mortality rates than individuals in the highest-income neighborhoods (Quintile 5), while those in the poorest neighborhoods demonstrated the highest rates.¹⁰ Previous research has shown that these patterns remained unchanged using the previous year's data and also held across gender-specific mortality rates, for deaths among those under 75 years of age, mortality by disease groups and mortality rates for five of the eight specific disease examined. Life expectancy for males and females showed the same trend, ranging from 65.3 years among males in the lowest-income neighborhoods to 76.6 years for those in the high-income areas, with a similar range for females, 74.4 to 82.1 years.

¹⁰ Income quintiles are geographic area measures of socioeconomic status derived from Canadian 1991 Census data. Census-derived household income data, aggregated to the geographic unit of the enumeration area, were used to rank neighborhoods by average household income (Mustard & Roos, 1994; Wilkins 1993; Krieger 1992). The top 20% of the population by mean neighborhood household income is identified as Quintile 5 and the poorest 20% as Quintile 1.

We have previously found rates of hospitalization to parallel the gradient in mortality rates. Across most measures including the rate at which individuals are hospitalized, the number of days spent in hospital, rates of hospitalization for chronic diseases in general and for specific diseases including hypertension, diabetes and pneumonia, residents of low-income neighborhoods had a much higher rate of hospitalization than residents of middle-income neighborhoods, who are in turn hospitalized much more frequently than residents of high-income neighborhoods (not presented here).

Figure 5: Expenditures per Resident per Year by Region, 1996

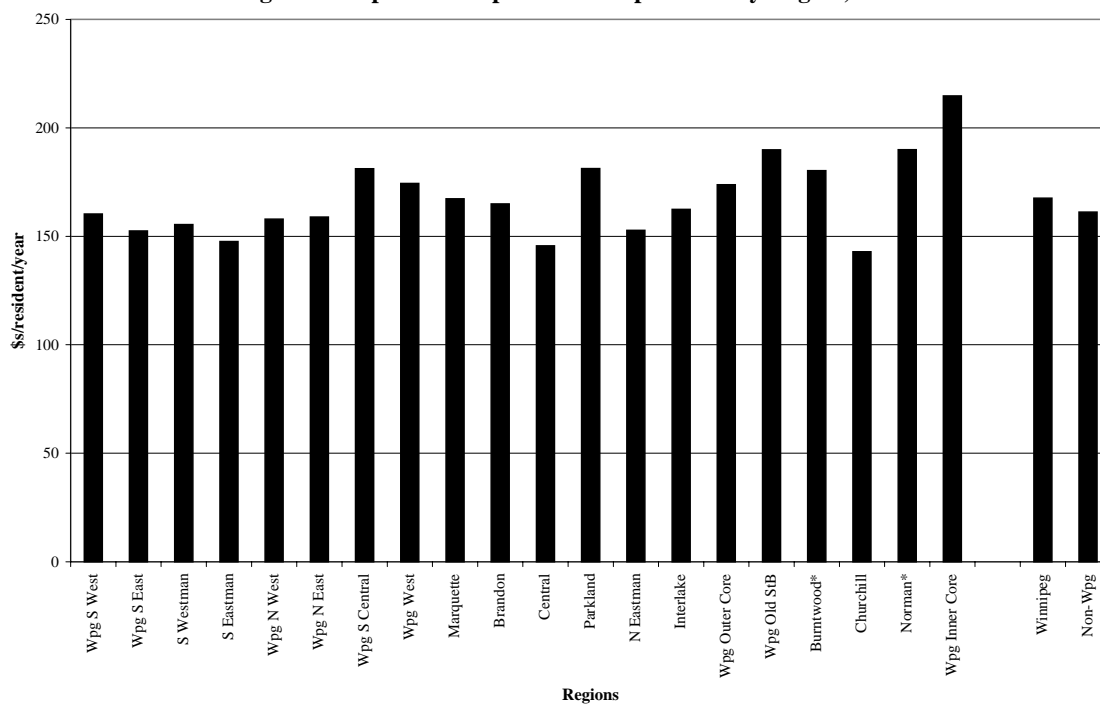


Figure 6: Trends in Residents' Use of ACE Inhibitors and Oral Hypoglycemic Agents by Region, 1996

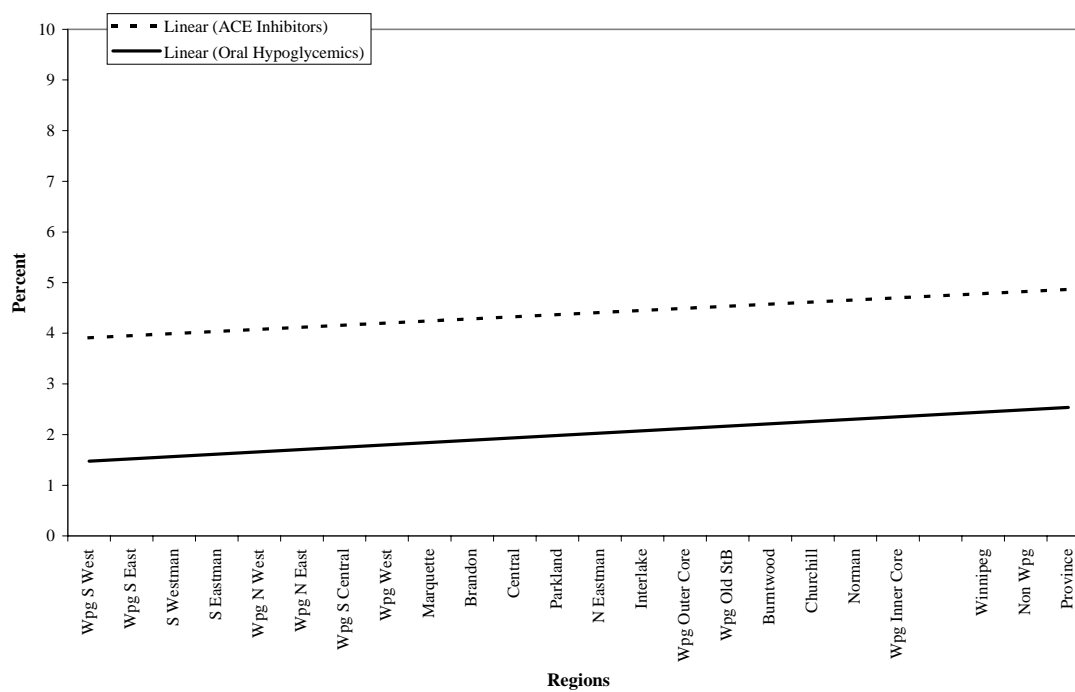
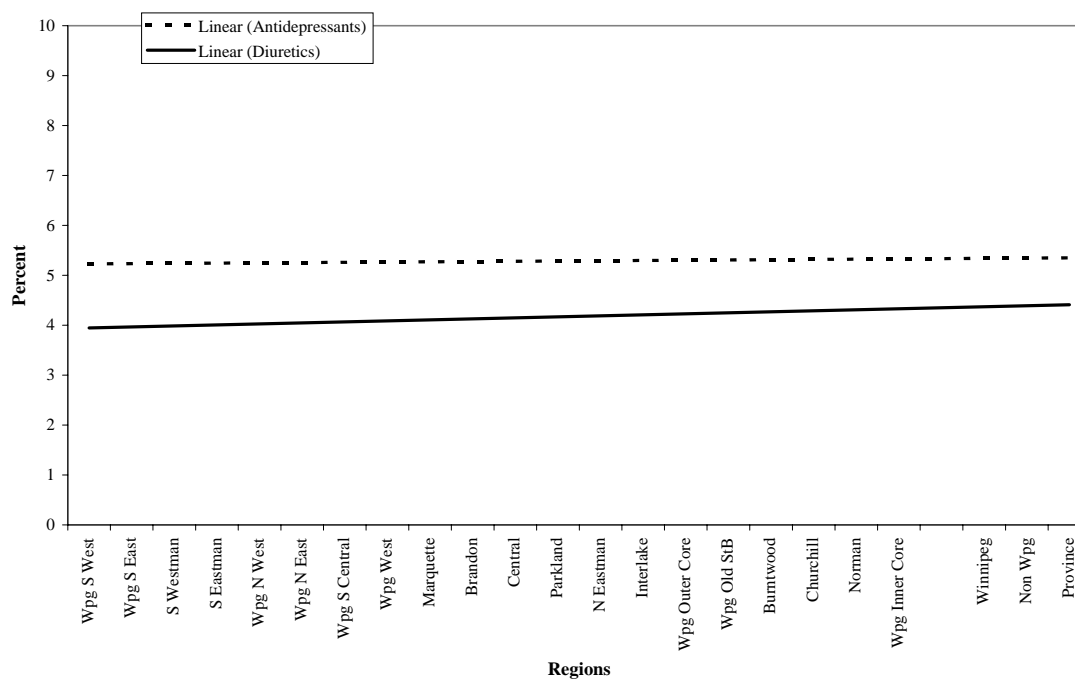


Figure 7: Trends in Residents' Use of Diuretics and Antidepressants by Region, 1996



Higher use of pharmaceuticals are also found in the lower income groups which are found to have the poorest health status (Table 6). That is, the higher the income quintile, the lower the proportion of users, the fewer numbers of prescriptions dispensed per resident and per user, the less intense the use by type of drug and the lower the expenditure per resident and user. There is an exception for Q5 expenditures, which are higher than Q4 for antidepressants.

Table 6. Pharmaceutical Use Measures by Income Quintile, Winnipeg 1996

	Access: % Using at least one Rx	Use: # prescriptions		Use of: Antidiabetic Agents Antiinfectives Antidepressants (DDDs/1000 residents/day)	Expenditures: (in dollars)	
		/resident	/user		/resident	/user
Q5 [highest]	66.7	4.8	7.3	11 / 16 / 26	154.46	234.72
Q4	67.3	5.1	7.7	14 / 16 / 25	151.27	228.35
Q3	68.2	5.7	8.3	16 / 16 / 26	163.60	241.06
Q2	68.5	6.1	8.9	19 / 16 / 30	168.75	247.07
Q1[lowest]	70.8	7.8	11.2	31 / 21 / 38	198.97	284.60

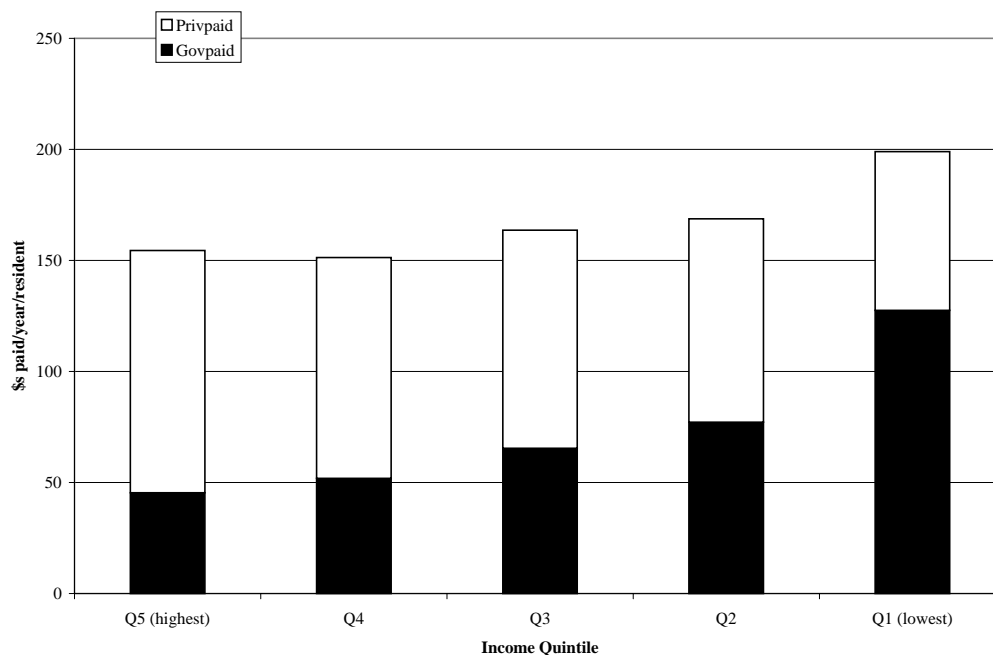
With the exception of individuals whose pharmaceuticals are paid 100% by a government agency (Winnipeg Social Services, Manitoba Family Services, personal care homes and Status Indians), some Manitobans see a portion of their pharmaceutical expenses paid by government. However, most pay privately either out-of-pocket or through private insurance copayments and premiums. Figure 8 shows how, as income decreases, the portion paid by government (in real dollars) increases.

3.7 Pharmaceutical Use by Drug Type (access, intensity, expenditures)

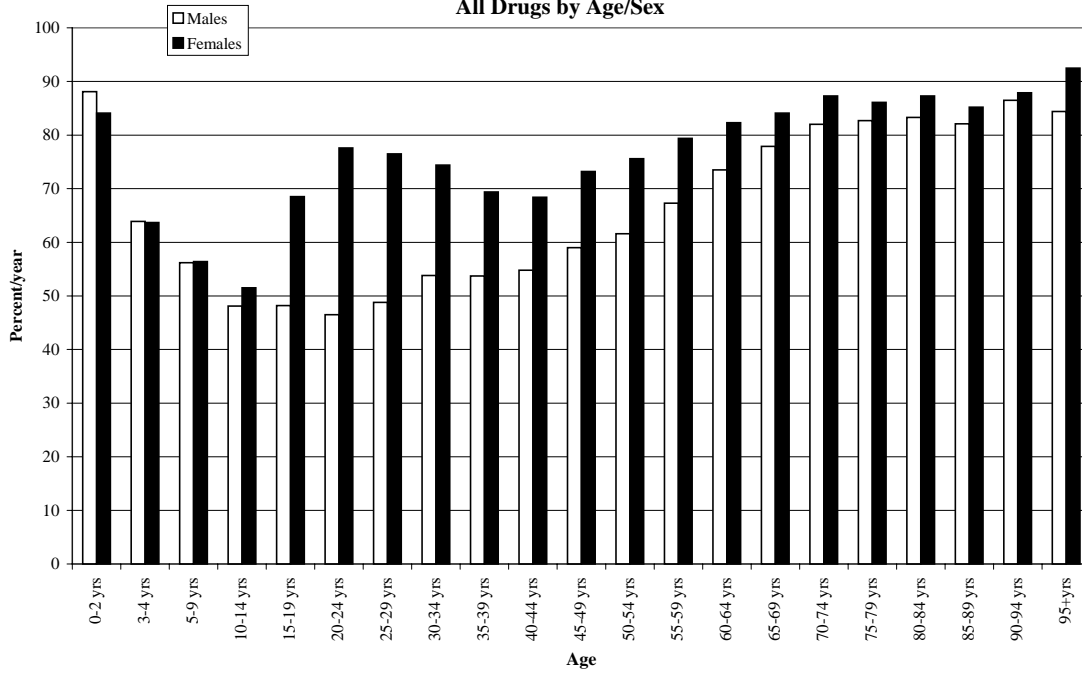
The following series of figures (Figures 9 to 20) reports pharmaceutical use of all drugs by measures per resident: access, intensity as measured by numbers of prescriptions, intensity as measured by defined daily dose and expenditures. Each measure is further described by age/sex, region and income quintile (Winnipeg). Pharmaceutical use by selected drug classes

can be found in Appendix III (Figures 21 to 104) and includes use of: antiinfectives, angiotensin converting enzyme (ACE) inhibitors, oral blood glucose lowering agents and nervous system drugs (antipsychotics, antidepressants, anxiolytics, hypnotics/sedatives).

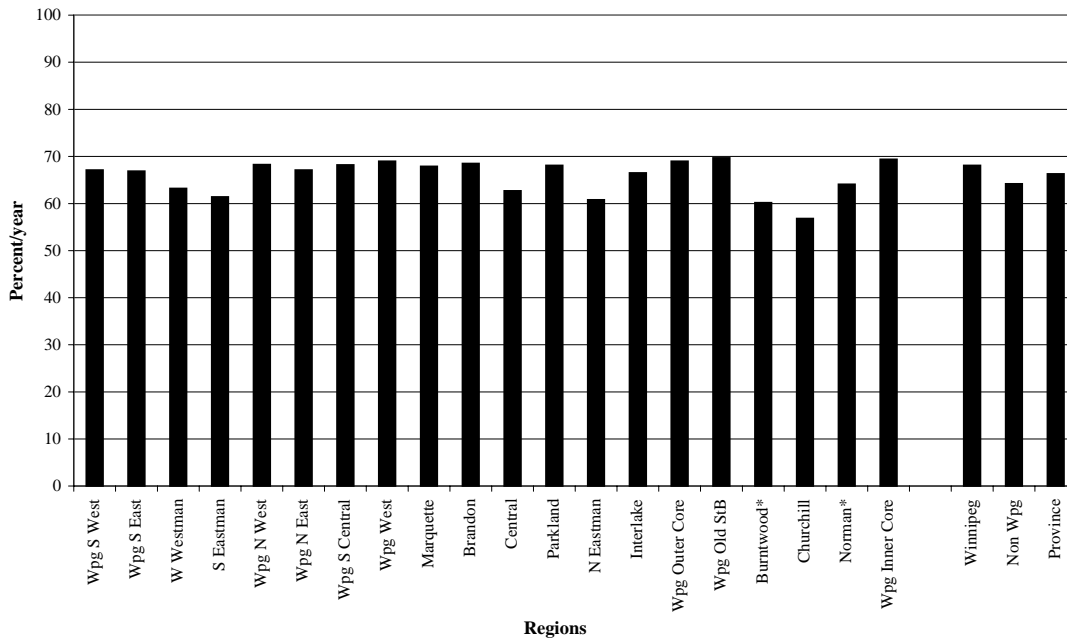
Figure 8: \$s Paid by Government vs. \$s Paid Privately by Winnipeg Residents by Income Quintile, 1996



**Figure 9: Access (to at least one prescription) Per Year
All Drugs by Age/Sex**

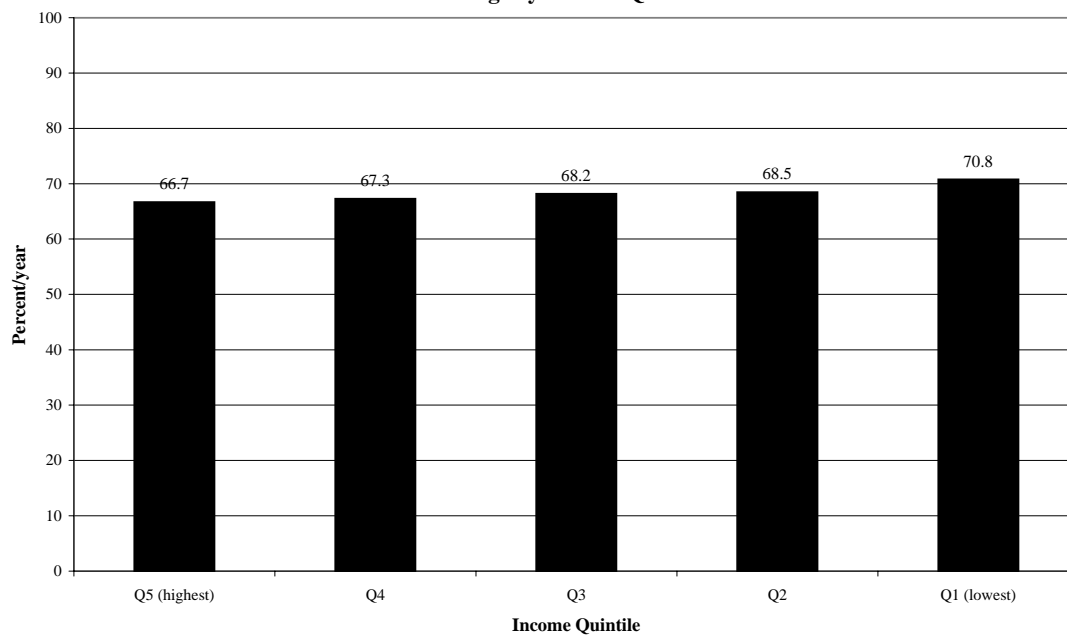


**Figure 10: Access (to at least one prescription) Per Year
All Drugs by Region**

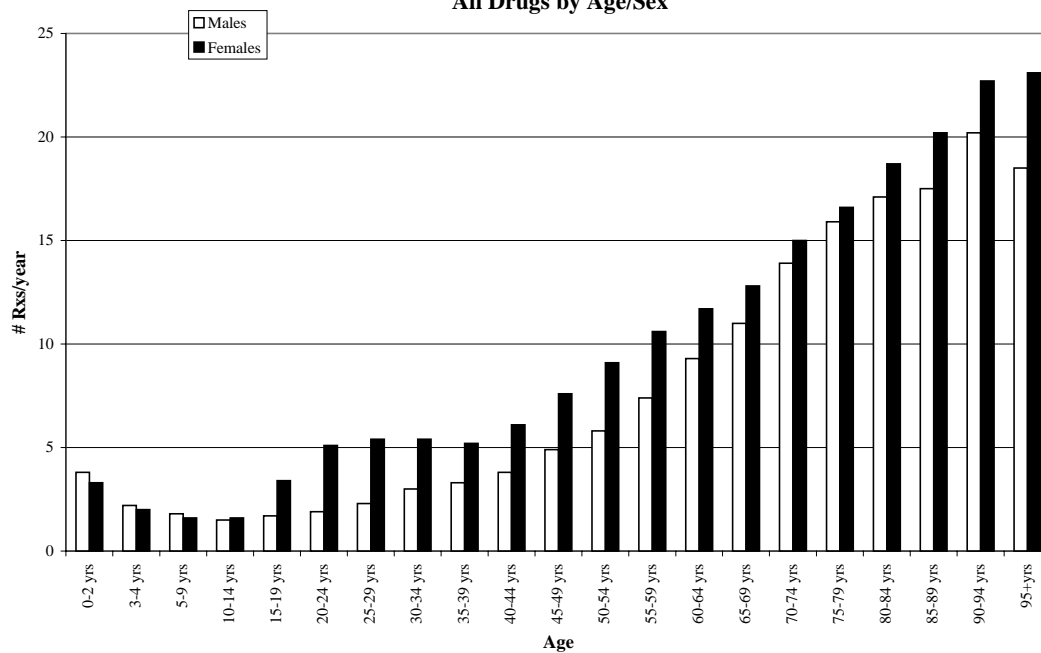


*Under-reporting due to nursing station dispensing

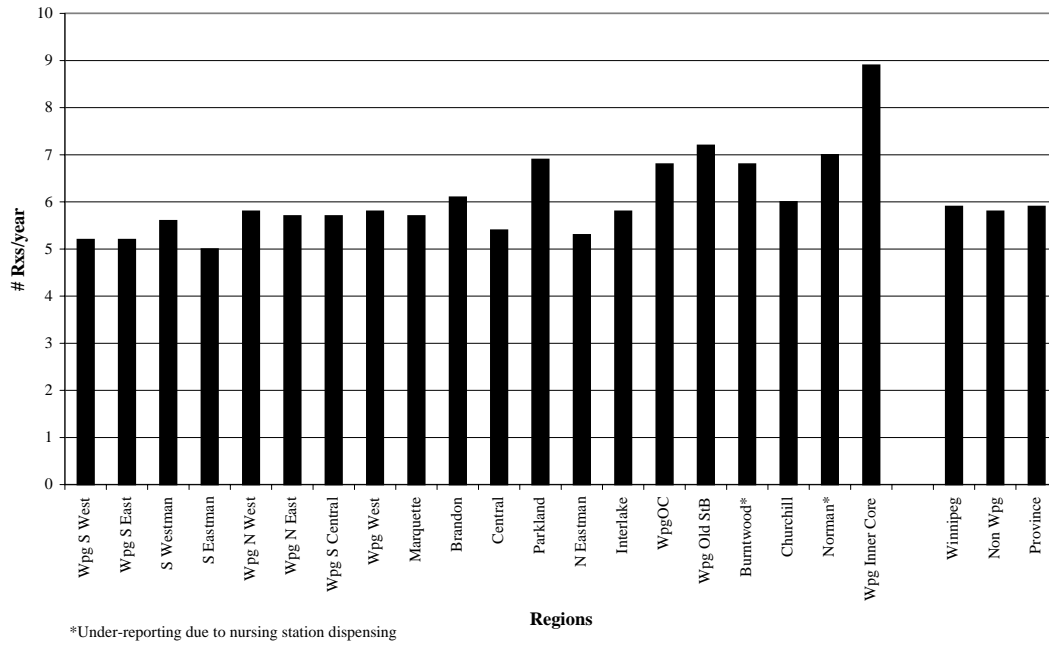
**Figure 11: Access (to at least one prescription) Per Year
All Drugs by Income Quintile**



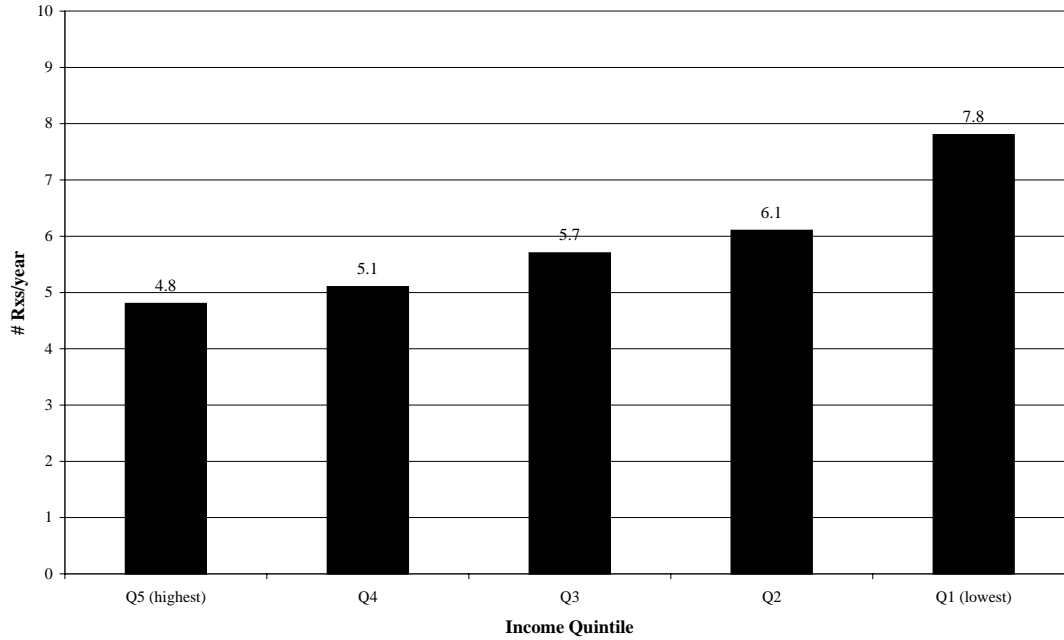
**Figure 12: Intensity of Use (# prescriptions/1000 residents) Per Year
All Drugs by Age/Sex**



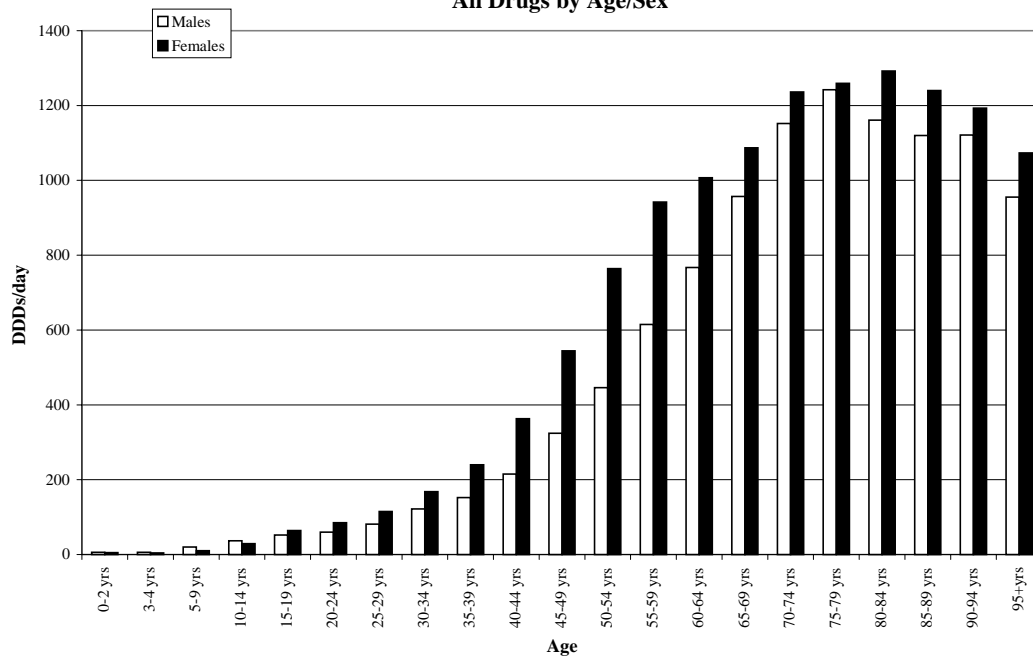
**Figure 13: Intensity of Use (# prescriptions/1000 residents) Per Year
All Drugs by Region**



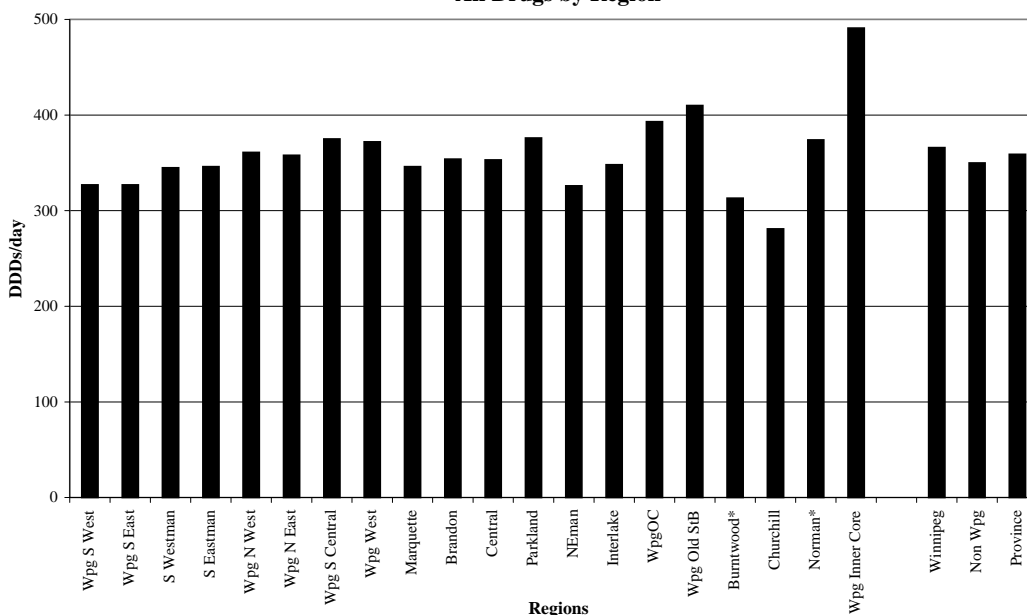
**Figure 14: Intensity of Use (# prescriptions/1000 residents) Per Year
All Drugs by Income Quintile**



**Figure 15: Intensity of Use (#DDD/1000 residents) Per Day
All Drugs by Age/Sex**

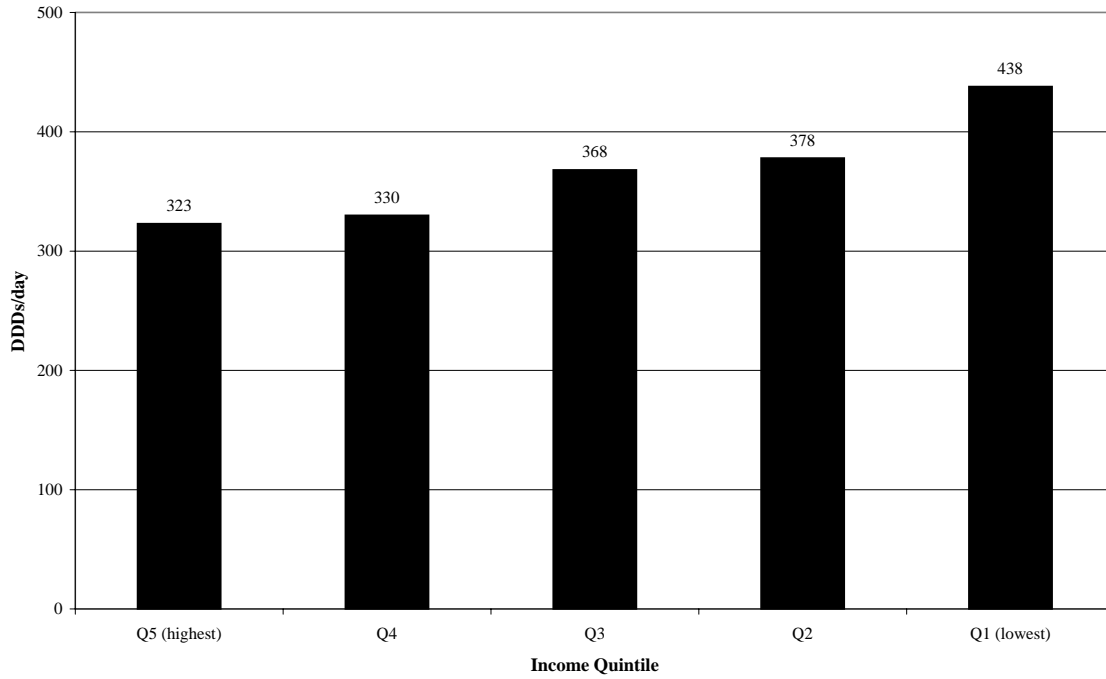


**Figure 16: Intensity of Use (#DDD/1000 residents) Per Day
All Drugs by Region**

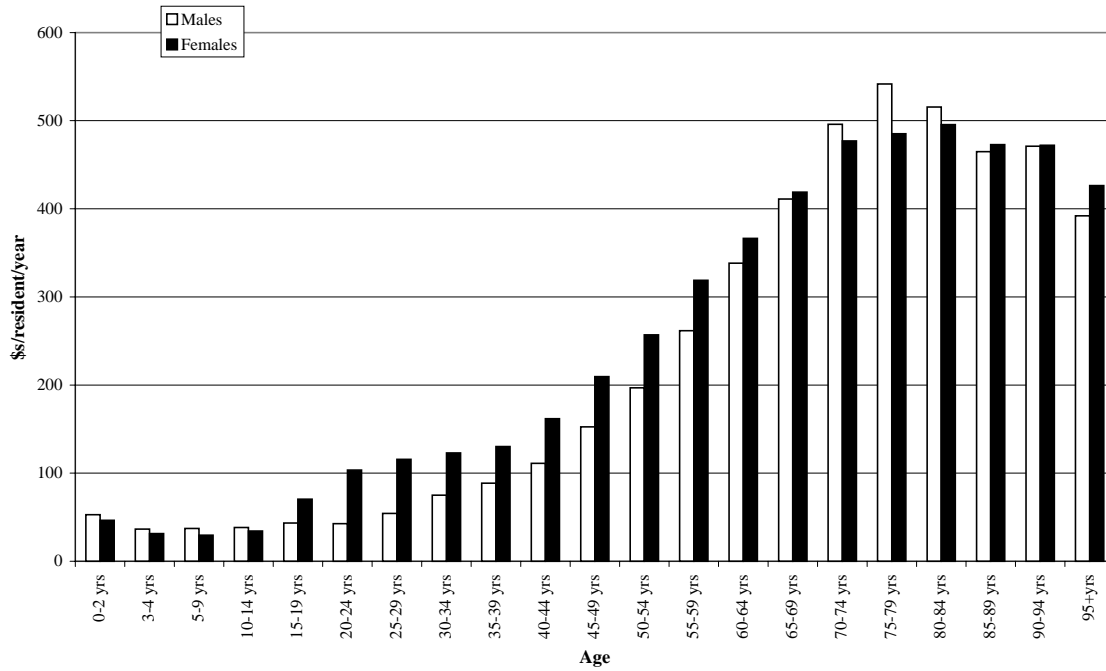


*Under-reporting due to nursing station dispensing

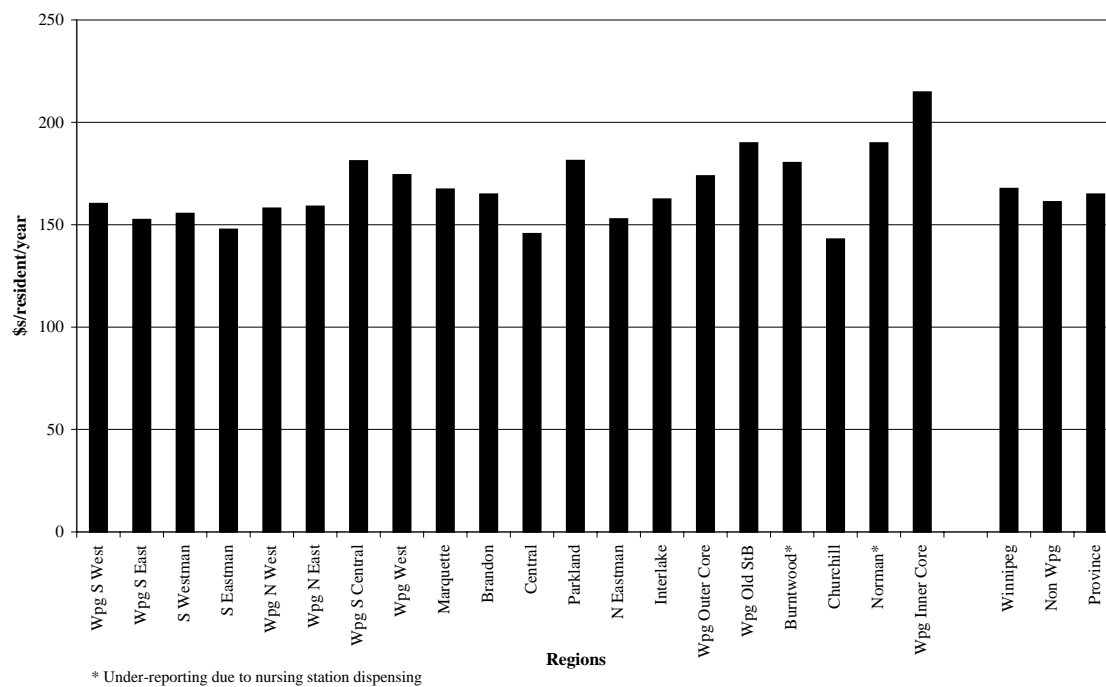
**Figure 17: Intensity of Use (#DDDs/1000 residents) Per Day
All Drugs by Income Quintile**



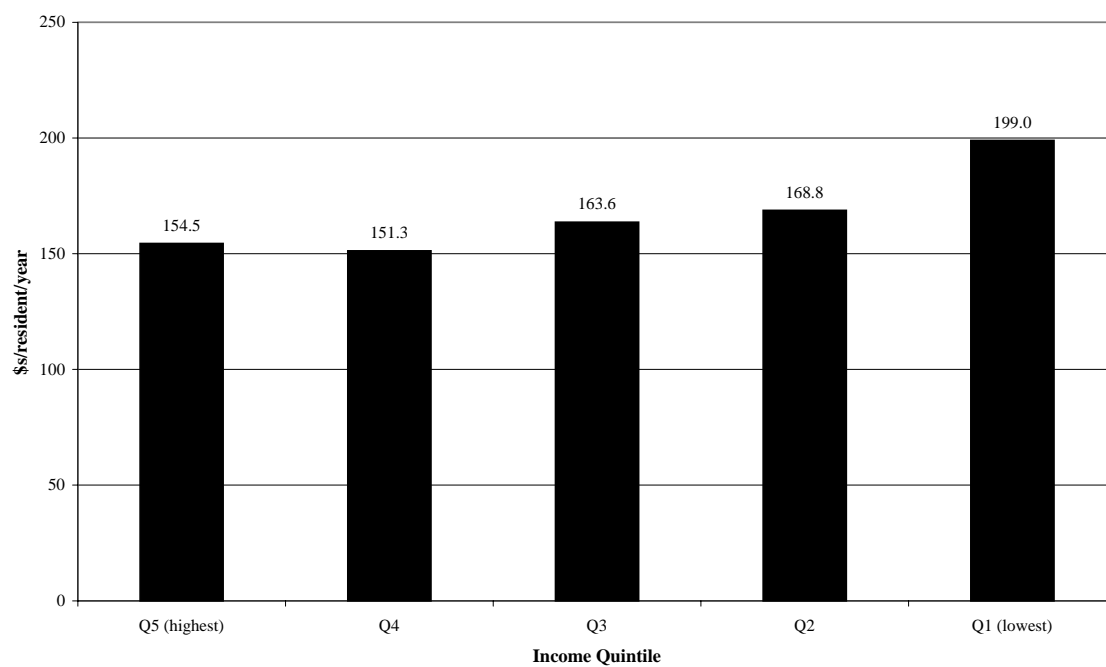
**Figure 18: Expenditures (\$/resident) Per Year
All Drugs by Age/Sex**



**Figure 19: Expenditures (\$/resident) Per Year
All Drugs by Region**



**Figure 20: Expenditures (\$/resident) Per Year
All Drugs by Income Quintile**



4. DISCUSSION

The intent of population-based analysis systems like POPULIS is to “...link socioeconomic determinants of health, personal behaviours that influence health, usage of health care resources, supply and capacity of the health care system and expenditures on health care so that better decisions can be made” (National Forum on Health, 1997).

There are many things in the data reviewed which support the use of Manitoba’s pharmaceutical data for population-based analyses. For example, in describing Manitoba’s use of pharmaceuticals at the regional level, despite regional variability, there is a pattern of differential response to different levels of population need. The regions with the highest use of pharmaceuticals were also those areas whose residents had the poorest health (as judged by rates of death among those 0 - 74 years of age) and the highest level of socioeconomic risk. In contrast, lower rates of use by higher income Winnipeg residents corresponded to good health status with this population.

As with all previous projects used to expand the POPULIS system, the first step has been to develop the population based concepts, to implement them on the new data set, and to investigate the validity of the data. Many of the analyses undertaken have been to explicitly replicate others’ findings as a method of checking data validity. The results have been very encouraging.

The completeness of the DPIN database in describing Pharmacare prescriptions is similar to the 94% reported for the United States Medicaid claims data bases (Ray & Griffin, 1989). In addition, DPIN Pharmacare prescription data is as reliable as prescription data in the RAMQ, Quebec’s prescription database, where 94% of prescriptions have matched original prescriptions with respect to the drug name and prescriber (Tamblyn et al., 1995). Thus, the DPIN prescription database is a valid and reliable source of prescription data for Manitobans receiving prescription benefits from Manitoba Health, but somewhat under-represents prescriptions dispensed for Status Indians.

For example, the patterns of use by age and sex are consistent with other research, which has found that age is highly correlated with the quantity of care and, in particular, the use of pharmaceuticals (Skoll et al 1979; Hale et al. 1987; Nolan & O'Malley 1988). As well, females use more pharmaceuticals throughout the adult years and not just during the childbearing period (Cooperstock et al. 1982; Power et al. 1983; Gormley et al. 1990; Rawson & D'Arcy 1991). The Manitoba figures reflect these patterns of use and are supported by data that shows that females make approximately 1.6 times the number of physician visits as do males in the 15-64 year age category (Tataryn et al. 1994).

Just as Quinn et al. (1992) found that two-thirds of the Saskatchewan population received a prescription drug at least once in 1989, so too did 66.4% of Manitobans receive a prescription in 1996. Also similar, however, were the number of residents dispensed an antiinfective (Saskatchewan 43.6% vs. Manitoba 40.3%) and the proportion of women over 65 year of age receiving benzodiazepines (Saskatchewan 20.3% vs. Manitoba 19.0%). Prescribing patterns over the intervening seven years between analyses appear not to have changed.

Access to pharmaceuticals, as measured by the proportion of the population receiving at least one prescription in a calendar year, varied by age, sex, income, extent of government payment coverage and somewhat by region of residence. Older residents of Manitoba (65 years of age and over) were more likely to be users of pharmaceuticals (841/1000 residents). This rate of use is consistent with Quinn et al.'s (1992) findings of 808/1000 residents 65 years of age and over. It is also consistent with increasing prevalence of chronic conditions and morbidity as the population ages (Black et al. 1995; Gurland & Cross 1982). The elderly in Manitoba, that is, those 65 years of age and over, comprise 13.6% of its population but account for 35.6% of the prescriptions dispensed and 39.0% of total pharmaceutical expenditures. These proportions are slightly less than those reported by Quinn et al. (1992).

There are limitations in the ability of this type of analysis to completely describe use of pharmaceuticals. For example, from an access to pharmaceuticals perspective, there is

significant underreporting in at least two northern regions of the province. The amount of underreporting in these two areas (20%) would account for approximately 1% of residents and prescription claims. The exclusion of non-solid dosage forms from the defined daily dose (DDD) rate calculations limited the full characterization of at least three classes of drugs: (1) those for asthma and other chronic respiratory conditions (inhaled β -2 agonists, corticosteroids), (2) insulin for diabetics and (3) oral liquid antiinfectives for children. We are developing algorithms to allow us to incorporate these and other preparations in a more comprehensive DDD analysis. As well, expenditure data had to be imputed for 15% of the prescription claims and the rates of expenditures per resident and per user may be somewhat biased as a result.

Having accomplished the first steps of describing the use of pharmaceuticals from a population-based perspective and establishing the validity of the data, there are now many new research opportunities. For example, when one considers intensity and type of drug use across the population, one is faced with perplexing questions about use that likely warrant further investigation. Given that ACE inhibitor use appears higher in the more needy regions of the province where the prevalence of diabetes is also higher, does this reflect appropriate use of ACE inhibitors among diabetics for hypertension or do other patterns account for this phenomenon? Similar questions can be asked about patterns of prescribing antidepressants, where urban populations receive 26% more drugs, but within urban populations, there is much higher intensity of use by low income populations. Or, does this reflect differences in disease patterns or practice patterns? These findings will be the subject of further study.

These analyses do not focus on physician prescribing patterns; rather this module of the Population Health Information System describes the pattern of pharmaceutical use by the population of defined areas, whether the pharmaceutical is dispensed in or out of the region of residence. For example, a prescription dispensed to a resident of Brandon in Winnipeg is counted in Brandon's residents' utilization rates. Although the analyses as presented raise many questions regarding regional differences in utilization, little attempt is made in this report to answer them — we simply seek to accurately describe the use of pharmaceuticals.

While the focus of these analyses has been to describe population-based, aggregate use of pharmaceuticals, in the future we will be able to describe condition-specific pharmaceutical use and drug-specific use. In other words, the extent to which the population receives optimal drug therapy will also be available from these data. We have the capability of calculating average dose dispensed per drug per patient treated, also known as the prescribed daily dose (PDD), which allows for rate calculations of the proportion of the population exposed to sub-therapeutic and excess doses of specific drugs. These rates will be essential in planned sub-analyses by therapeutic drug class.

As well, the strength of the pharmaceutical use data is in its integrative potential with other POPULIS modules. By linking the socioeconomic pharmaceutical use patterns to data on what type of physicians provide care to whom (See Roos et al., *Issues in Planning for Specialist Physicians*, Medical Care Supplement, June 1999, where we find specialist use among those in the low income neighbourhoods to be low relative to their health status), interesting questions can be raised. Is there a different pattern of care delivered, that is, a different mix of pharmaceutical use and medical care for patients with serious mental disease who live in different parts of the province? Are there different patterns of drug treatment for diabetics in rural areas who are hospitalized frequently versus those who aren't? In addition, the potential to study patient adherence to drug therapy over time exists with this dataset as well as the potential to link drug therapy data and population-based survey data. Finally, using linked population-based information including the use of pharmaceuticals to identify problems and then to monitor the effectiveness of the policy initiatives put in place to resolve these problems will present a powerful tool for more effectively managing pharmaceutical use within the health care system (Roos et al. 1998).

The reaction from medical faculty colleagues and other clinical researchers has been very positive about the research possibilities which accrue to having population wide data on pharmaceutical use. The classic use of these data for studies focussing on individual agents, duplicate therapy, interaction/reactions, therapeutic appropriateness, long term monitoring for complications are obvious. However, expanding clinical/epidemiologic/health services research mindsets to encompass an understanding of the unique opportunities offered by the

population-based availability of data and by the possibilities of linking pharmaceutical use patterns to other characteristics of the delivery system — how medical care is delivered — presents a challenge. However, we would argue this population-based perspective is the direction from which the major contributions about the role of pharmaceuticals in contributing to population health and their appropriate role in the health care system will come. For example, we have demonstrated that it is possible to reliably identify those with chronic diseases using hospital and medical claims: diabetics, hypertensives, those with serious mental disorders. How are diabetics treated? How do treatment patterns vary across different groups in the population (by age, by socioeconomic characteristics), those treated by different types of physicians (rural versus urban; specialist versus generalist)? What are the observed outcomes (rates of diabetic complications, rates of hospitalization) associated with different patterns of treatment?

Only with population based system wide health care data can the “big picture” questions be addressed:

Access: How does access to pharmaceutical agents vary across the population? Do healthier populations have access to more or to different drugs? How do these patterns vary for individuals who have defined morbidity (i.e. diabetes, hypertension, etc.) according to geographic location or socioeconomic standing? To what extent do patterns of physician use influence these patterns?

Intensity: To what extent do different populations appear to receive levels of medication that are higher or lower than one would expect, given standard uses of the medications? Is there evidence that some populations are receiving higher levels than would be expected? Lower levels than would be expected? What factors would explain these differences in drug intensity?

Quality: For key indicator conditions, What percent of the population receives potentially appropriate pharmaceuticals in appropriate doses? How does this vary by population characteristics (e.g. geography, SES status)?

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APPENDIX I

Imputation Formulas

For those individuals either receiving social service from Winnipeg city or designated as Status Indians and having prescriptions dispensed, data extracted did not include any expenditure data [n=175 337 persons representing 1 004 431 (15.0%) claims]. Expenditure data was imputed for these claims. Both ingredient costs and professional fees for dispensing were imputed. To impute a professional fee per prescription for these claims, we used the professional fee mode (a probabilistic value) from the Manitoba Family Services plan. Ingredient cost for these claims were imputed from the Manitoba Family Services plan using the product of two fields: metric quantity dispensed [MQTY] \times unit price mode per metric quantity. However, there was a consistency problem with MQTY. Many drug products can be described using multiple metric quantity descriptions. For example, the metric quantity in the DPIN database for a 200 mL bottle of 250 mg/5mL amoxicillin could be described as: 1 (bottle), 200 mL, 100 g or 10,000 mg. We used the following rule to impute metric quantity: if MQTY (of the claim) was $> 90\%$ percentile and > 20 times the MQTY mode, then MQTY mode (from Manitoba Family Services) was imputed.

Days supply and a professional fee for dispensing are not included in the personal care home (PCH) or nursing home data; a professional fee was imputed for PCH claims and rates requiring days supply in the calculation (e.g., DDDs) do not include the residents of PCHs. There were 300 699 prescriptions dispensed (or 4.5% of total 1996 claims) for personal care home residents. A professional dispensing fee had to be imputed for all these claims because of the current method of reimbursement to pharmacies providing these services. Reimbursement to pharmacists for dispensing to PCHs is based on a capitated rate per bed exclusive of ingredient cost. This rate is different for pharmacies dispensing pharmaceuticals inside the city of Winnipeg or rurally (\$ 26.45 vs. \$29.95 per bed per month). A fee for Winnipeg and non-Winnipeg PCH claims was calculated on a monthly basis (total beds \times capitation rate \div number of prescriptions claims/month) and then imputed for all PCH claims.

APPENDIX II

Additional Validity Checks Undertaken

Before rate analyses were undertaken, the following issues required clarification including an enumeration of the data actually available to use for analysis. The following is a list of tasks undertaken and issues considered in order to validate and complete the data for rate calculations:

- Determination of age definitions that would match existing Centre analysis modules.

- Ensuring that all data from personal care homes (PCH), Status Indians and Winnipeg Social Services were complete. For example, PCH prescriptions were switched over a one year period from an overall health care claims mainframe to a stand-alone electronic claims processing system (DPIN) and, therefore, we checked that only one entry existed for one claim (prescription).

- Identification of region of residence for PCH residents and Status Indians.

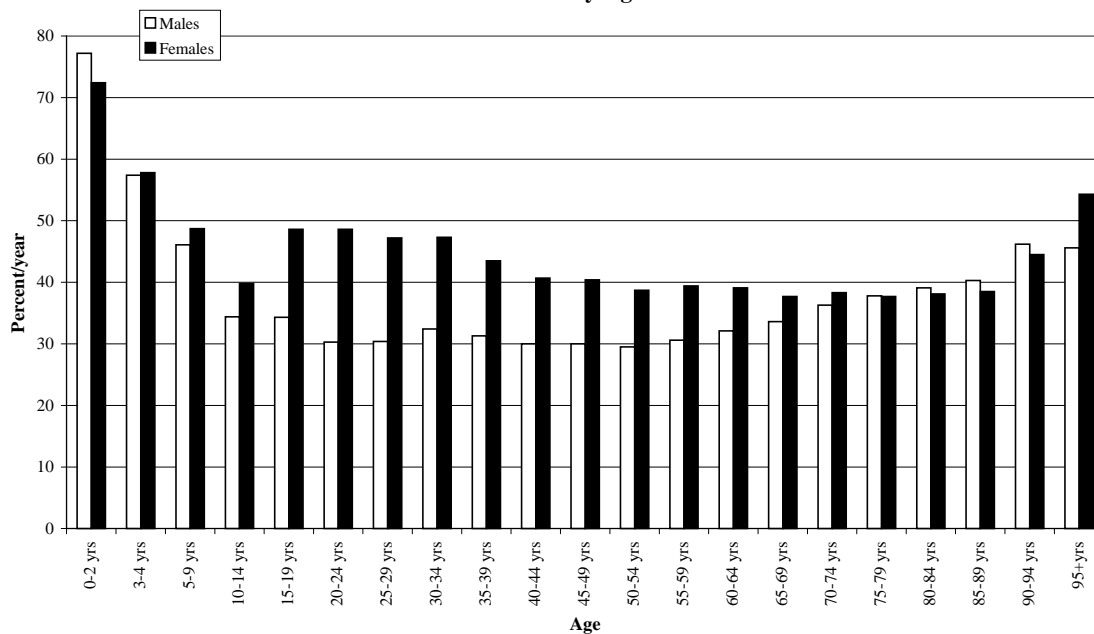
- Accuracy of coding pharmaceuticals for grouping purposes. For example: 24.6% [44/179] of American Hospital Formulary System [AHFS] codes were inaccurate and had to be corrected. Also, the ATC (Anatomical Therapeutic Chemical) file received from another jurisdiction had used a different version of this classification system for the fifth level.

- PCH residents were removed from the denominator for income quintile analysis.

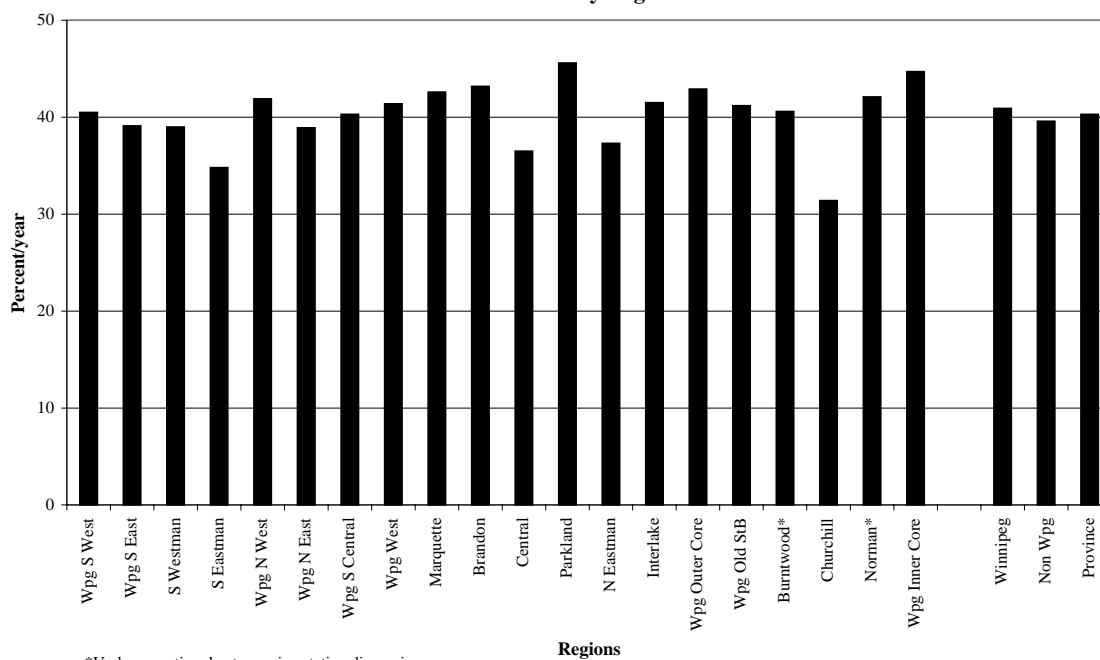
APPENDIX III

ANTIINFECTIVES

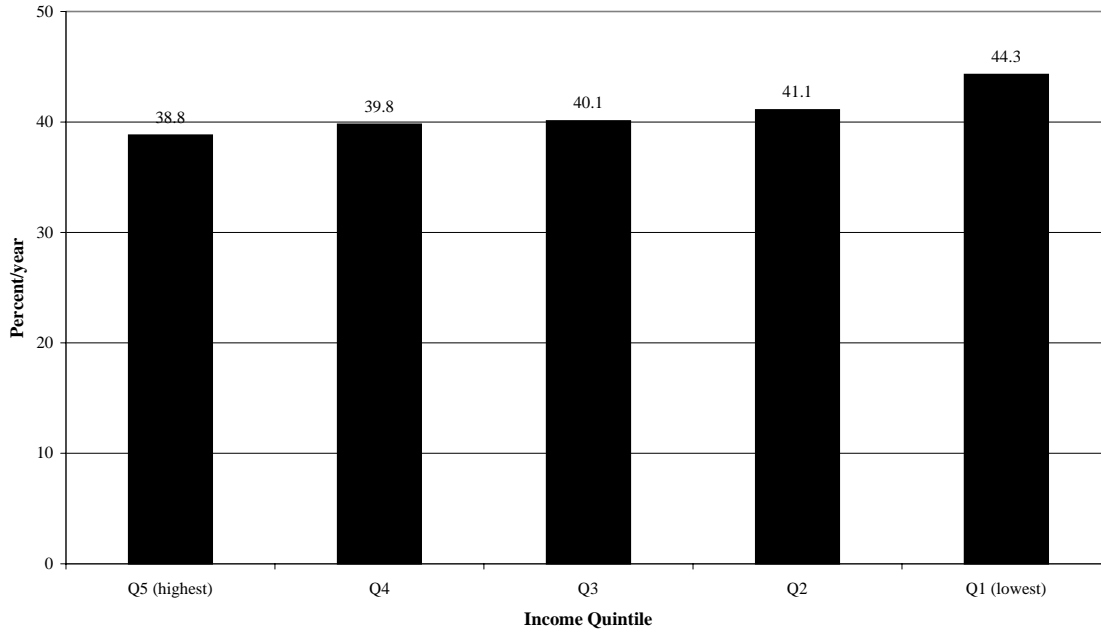
**Figure 21: Access (to at least one prescription) Per Year
Antiinfectives by Age/Sex**



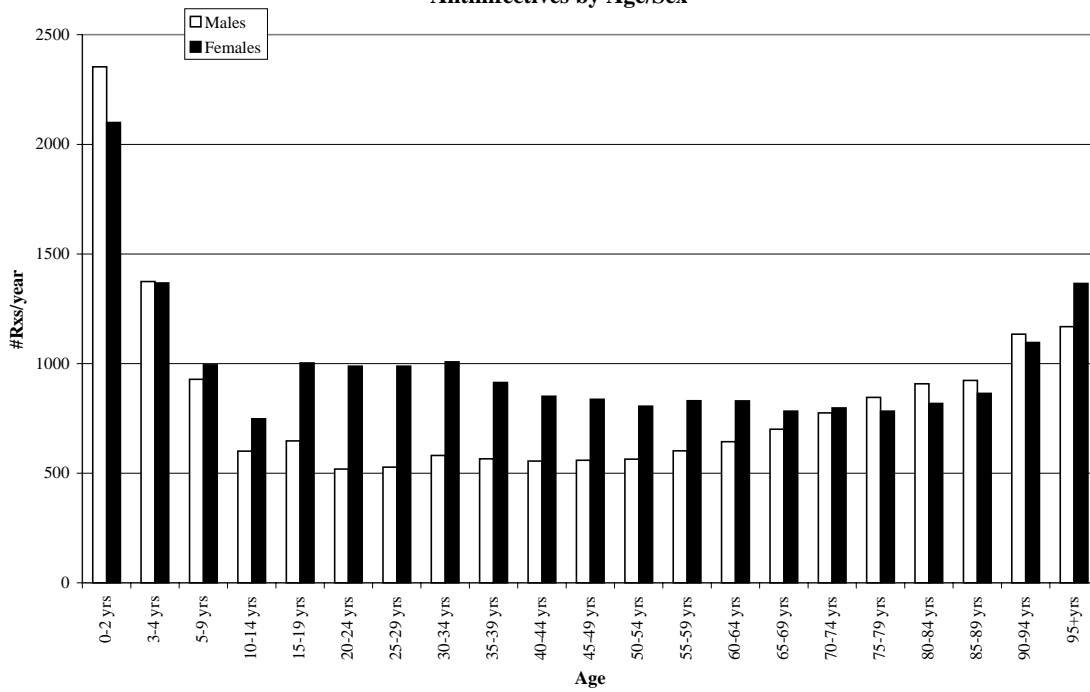
**Figure 22: Access (to at least one prescription) Per Year
Antiinfectives by Region**



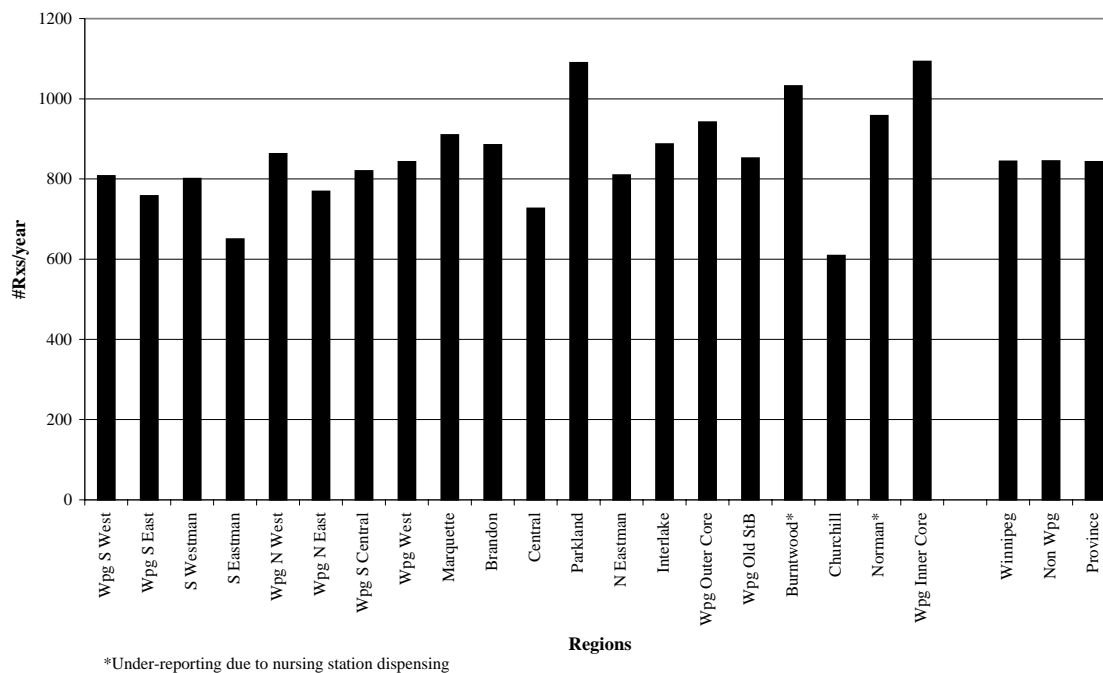
**Figure 23: Access (to at least one prescription) Per Year
Antiinfectives by Income Quintile**



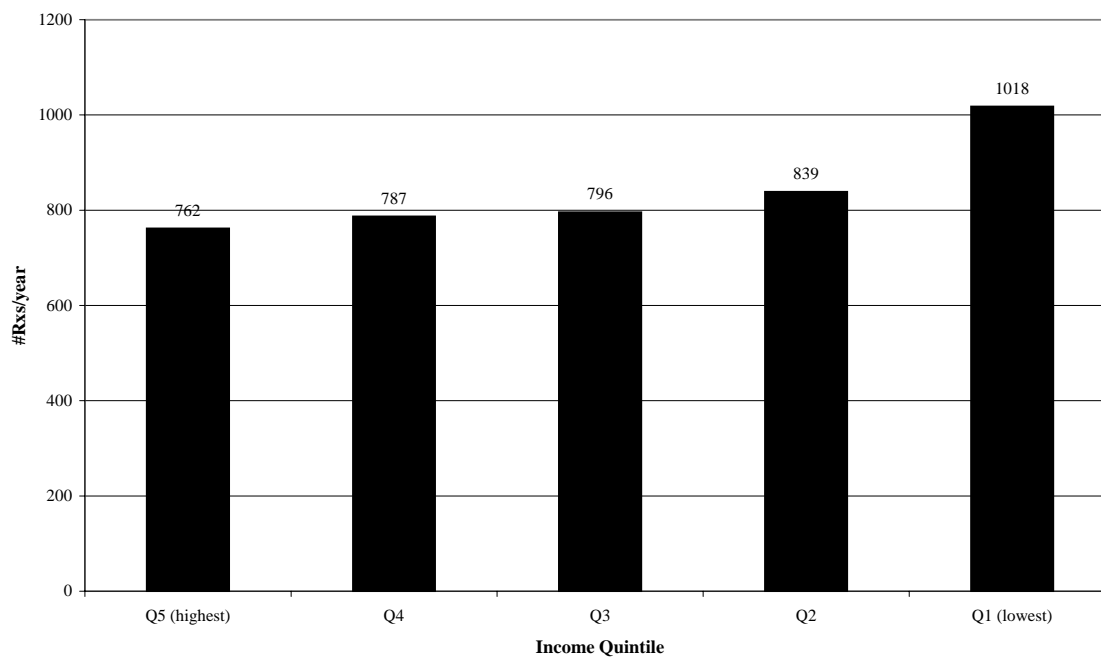
**Figure 24: Intensity of Use (# prescriptions/1000 residents) Per Year
Antiinfectives by Age/Sex**



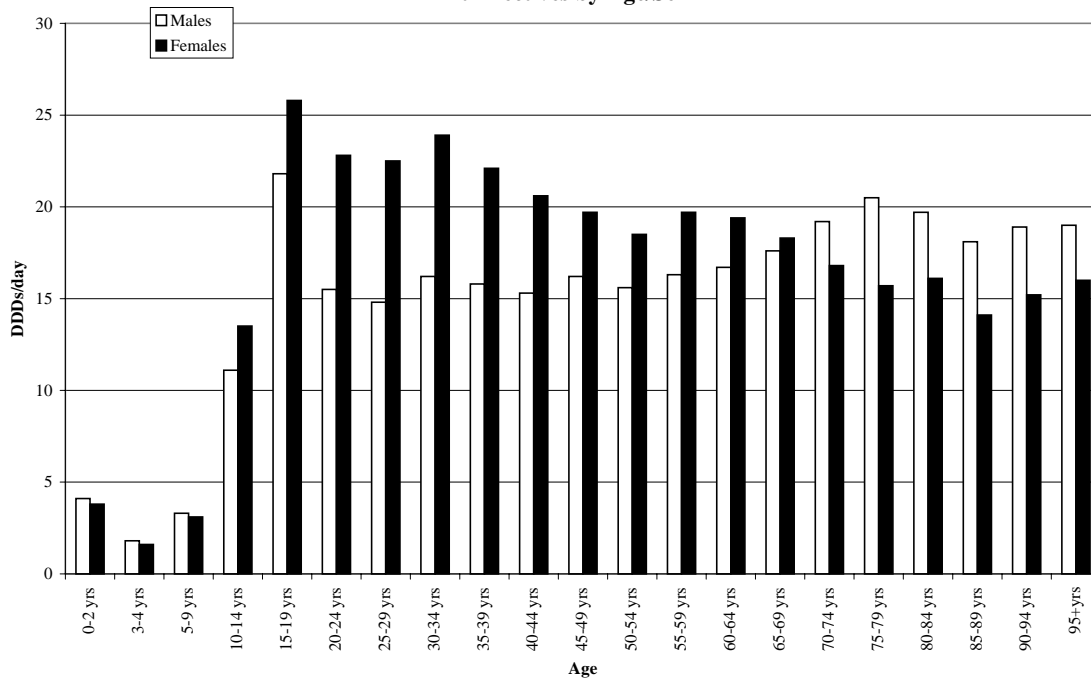
**Figure 25: Intensity of Use (# prescriptions/1000 residents) Per Year
Antiinfectives by Region**



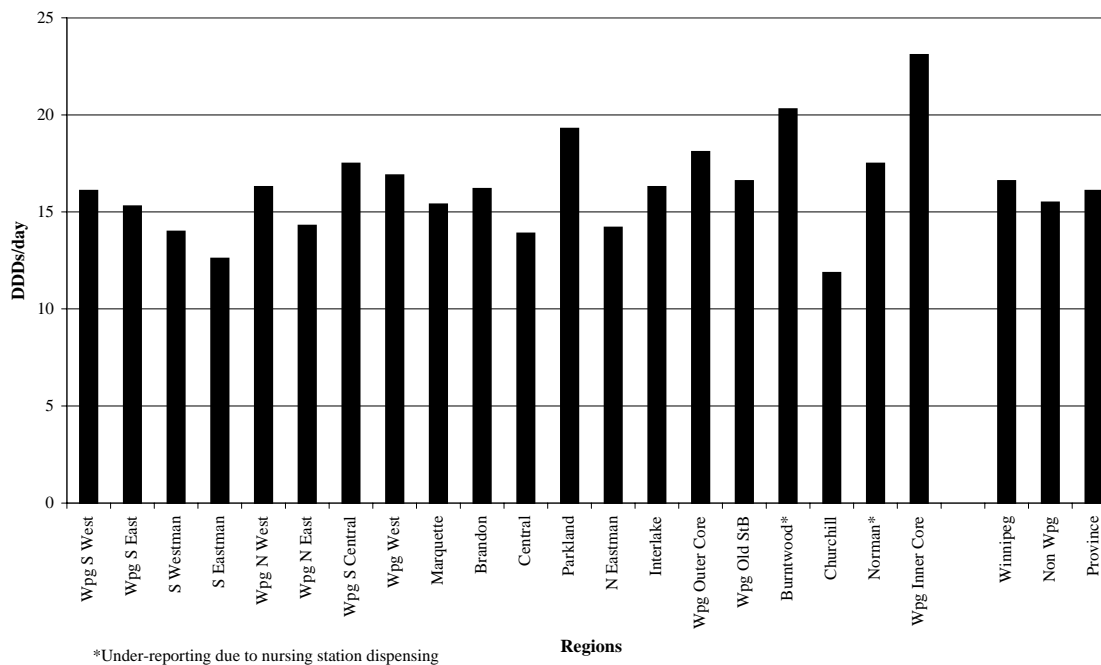
**Figure 26: Intensity of Use (# prescriptions/1000 residents) Per Year
Antiinfectives by Income Quintile**



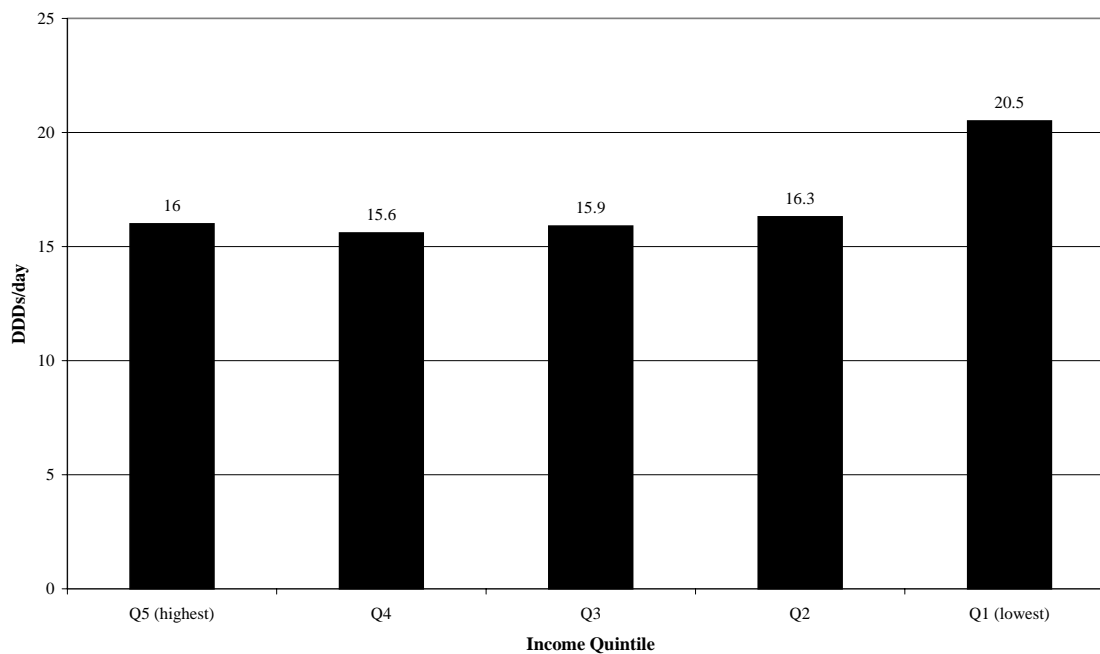
**Figure 27: Intensity of Use (#DDDs/1000 residents) Per Day
Antiinfectives by Age/Sex**



**Figure 28: Intensity of Use (#DDDs/1000 residents) Per Day
Antiinfectives by Region**



**Figure 29: Intensity of Use (#DDD/1000 residents) Per Day
Antiinfectives by Income Quintile**



**Figure 30: Expenditures (\$/resident) Per Year
Antiinfectives by Age/Sex**

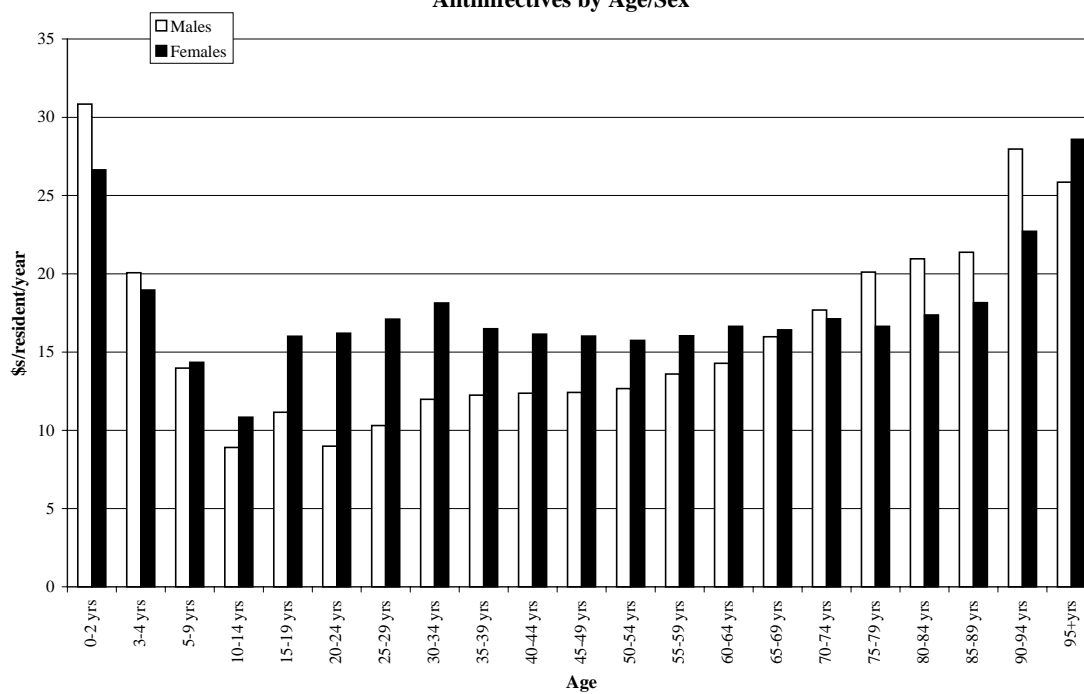


Figure 31: Expenditures (\$/resident) Per Year Antiinfectives by Region

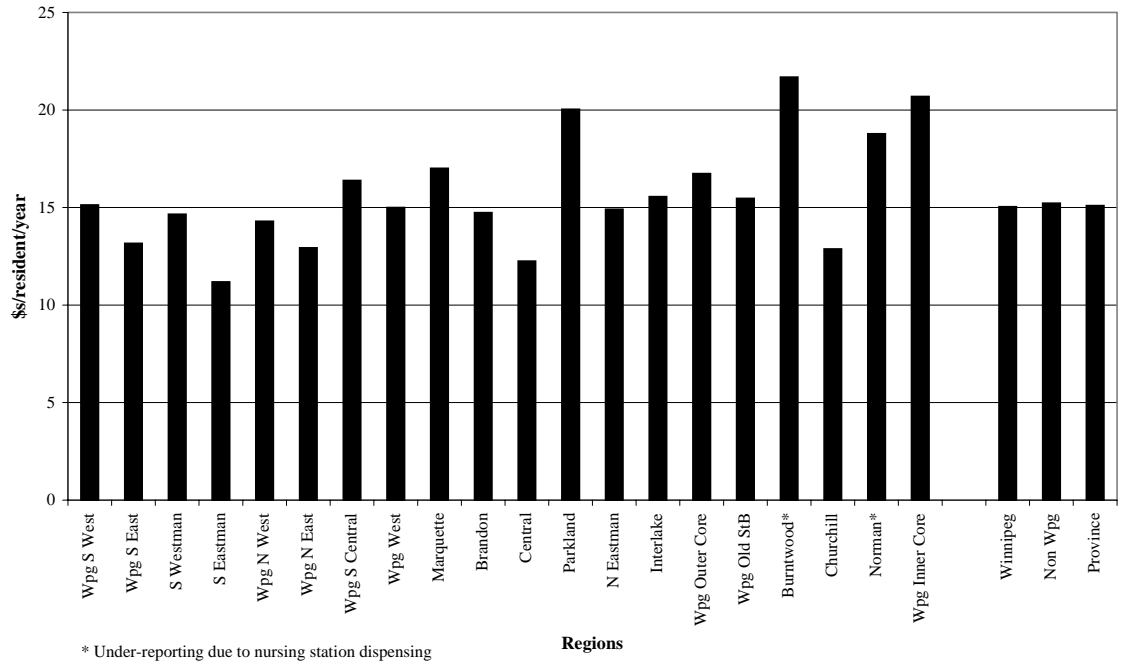
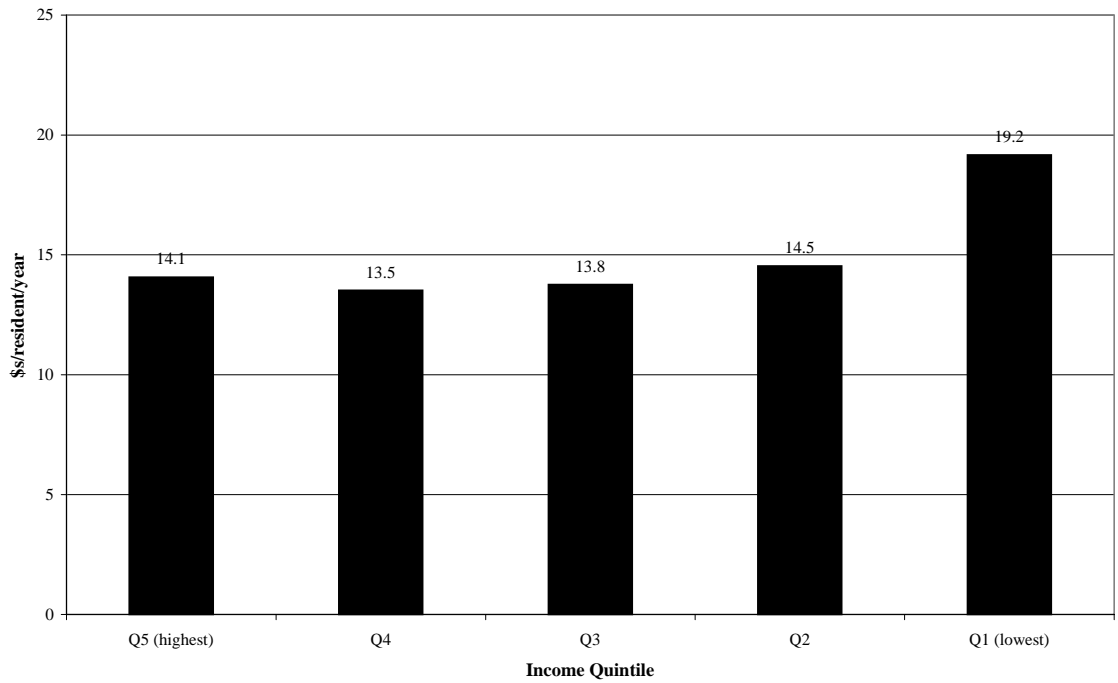
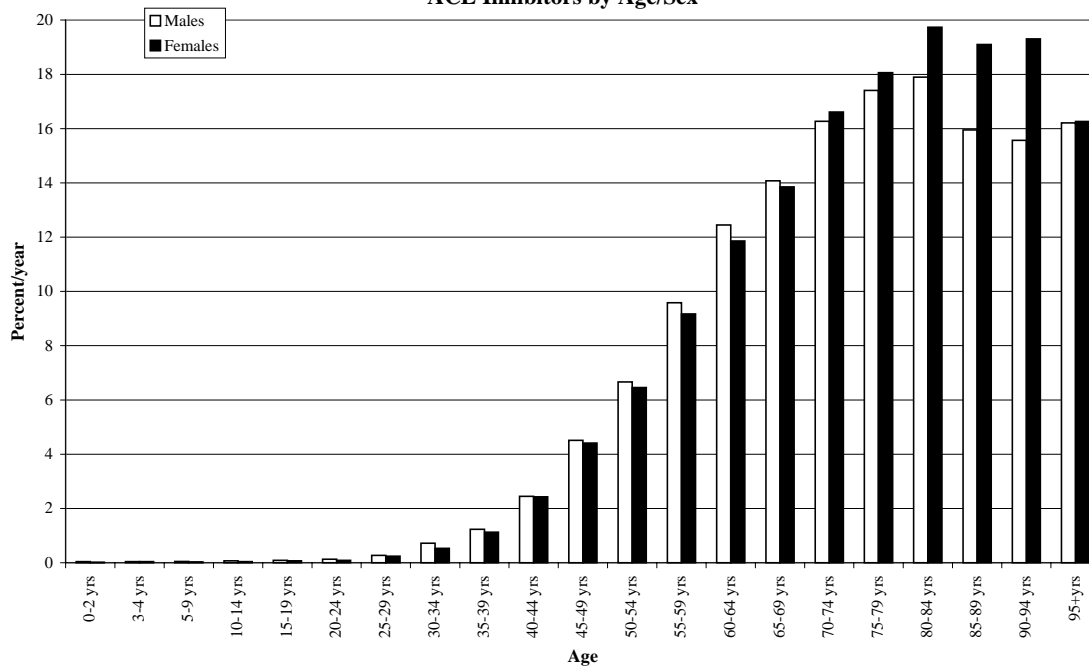


Figure 32: Expenditures (\$/resident) Per Year Antiinfectives by Income Quintile

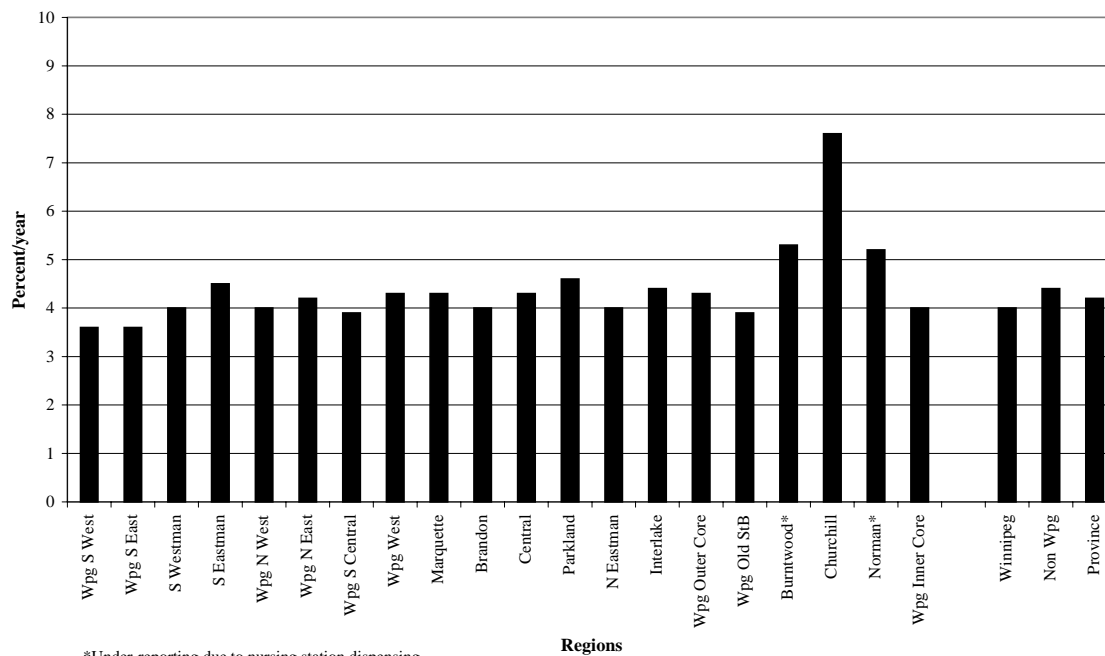


ANGIOTENSIN CONVERTING ENZYME (ACE INHIBITORS)

**Figure 33: Access (to at least one prescription) Per Year
ACE Inhibitors by Age/Sex**

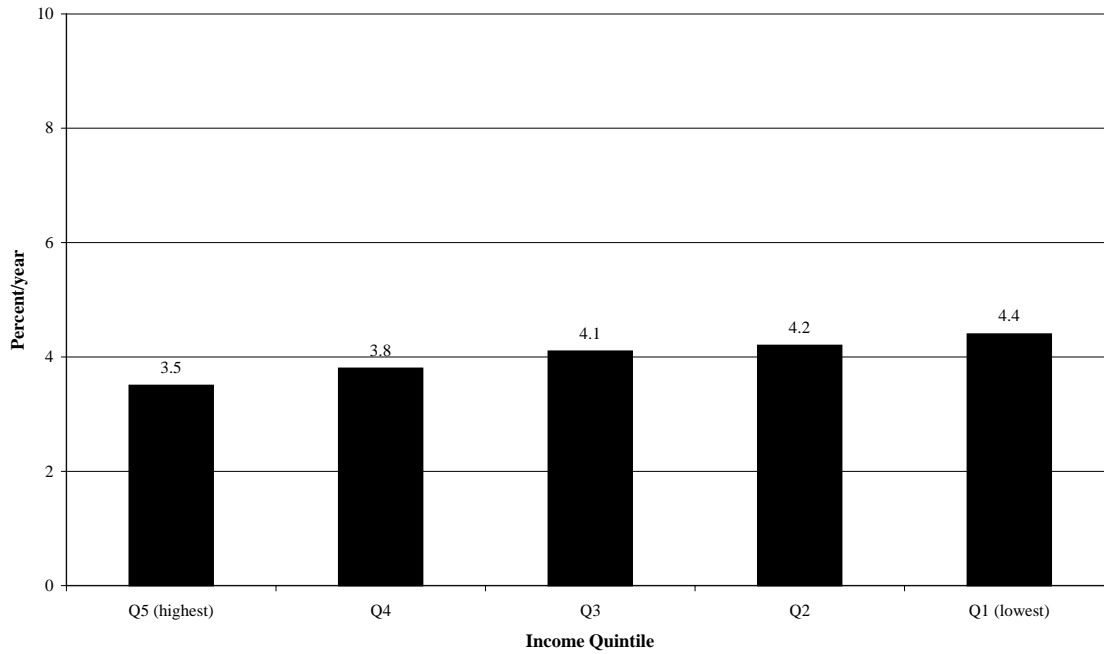


**Figure 34: Access (to at least one prescription) Per Year
ACE Inhibitors by Region**

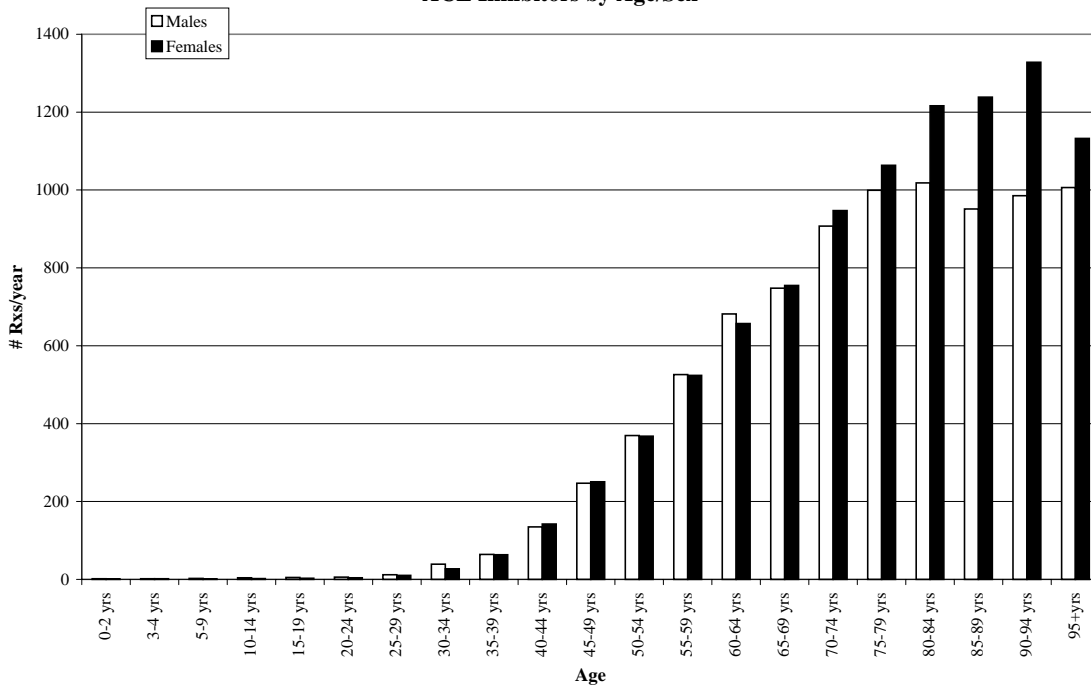


*Under-reporting due to nursing station dispensing

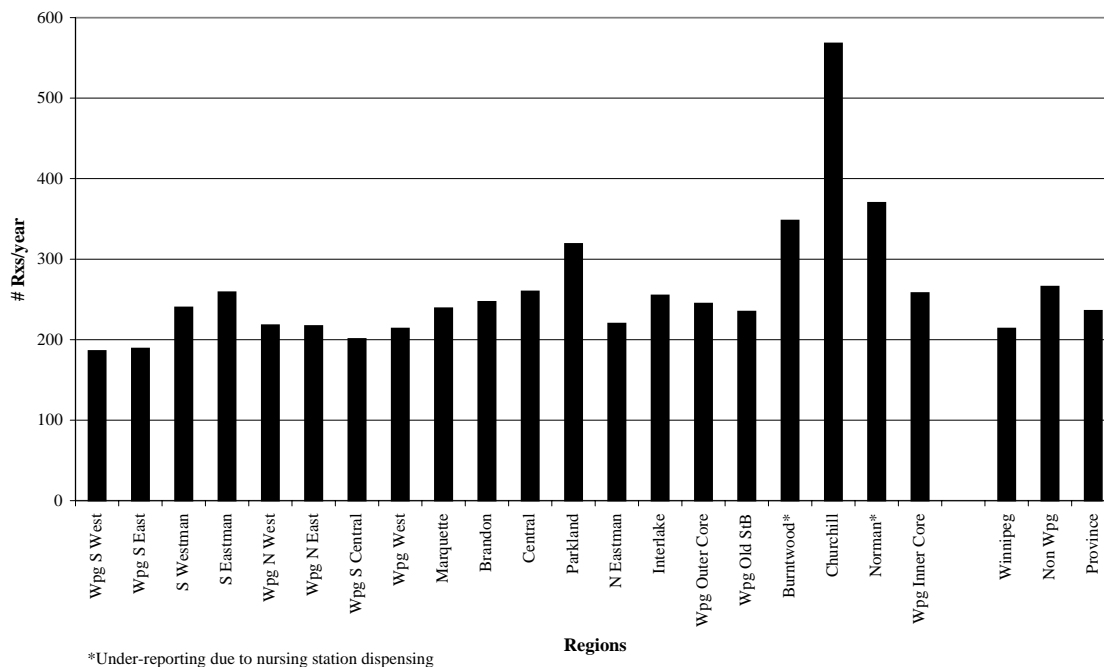
**Figure 35: Access (to at least one prescription) Per Year
ACE Inhibitors by Income Quintile**



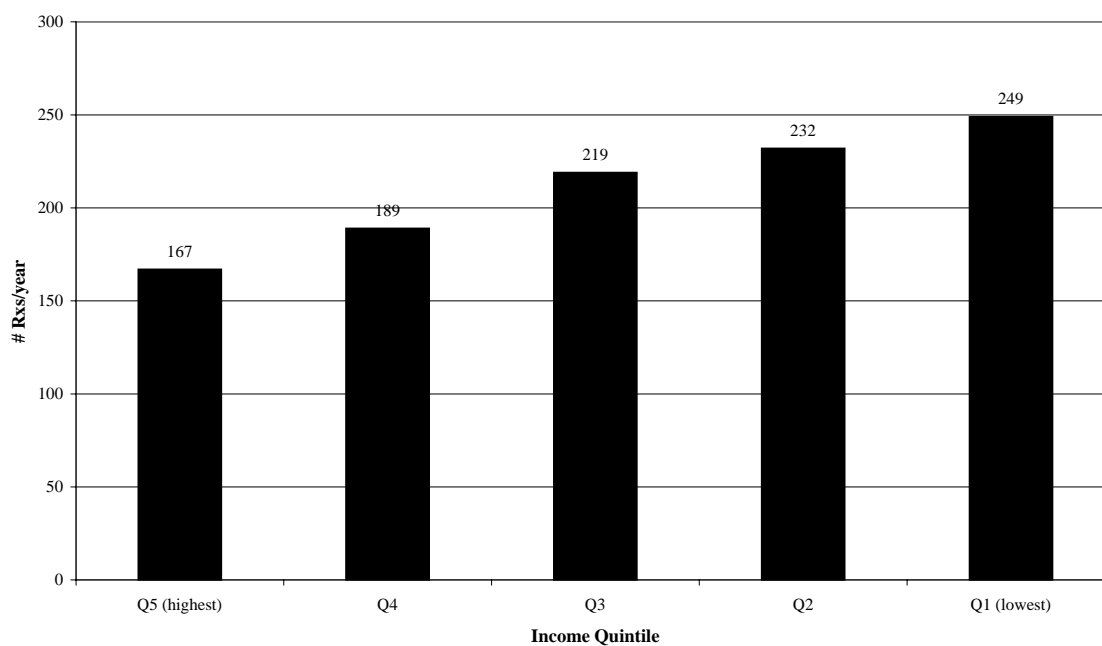
**Figure 36: Intensity of Use (# prescriptions/1000 residents) Per Year
ACE Inhibitors by Age/Sex**



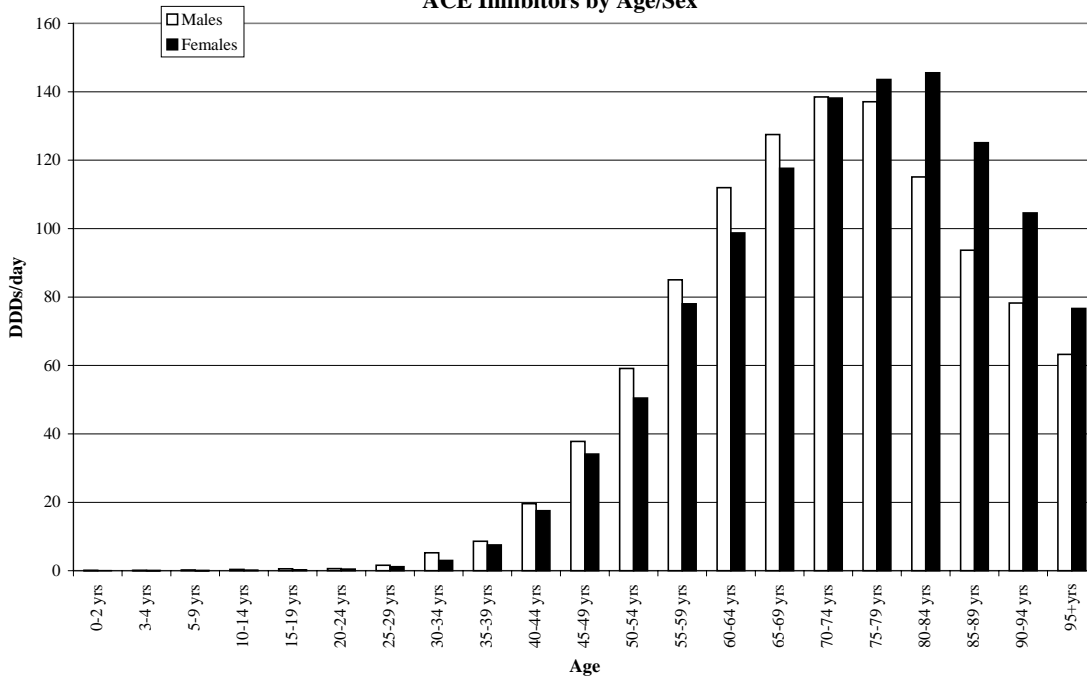
**Figure 37: Intensity of Use (# prescriptions/1000 residents) Per Year
ACE Inhibitors by Region**



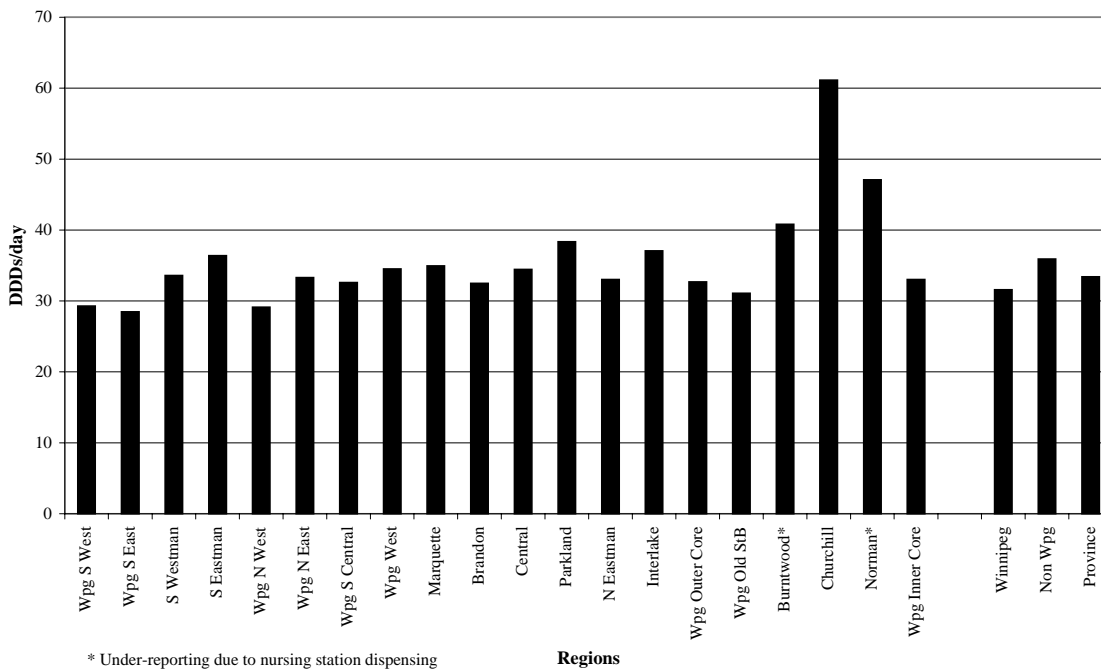
**Figure 38: Intensity of Use (# prescriptions/1000 residents) Per Year
ACE Inhibitors by Income Quintile**



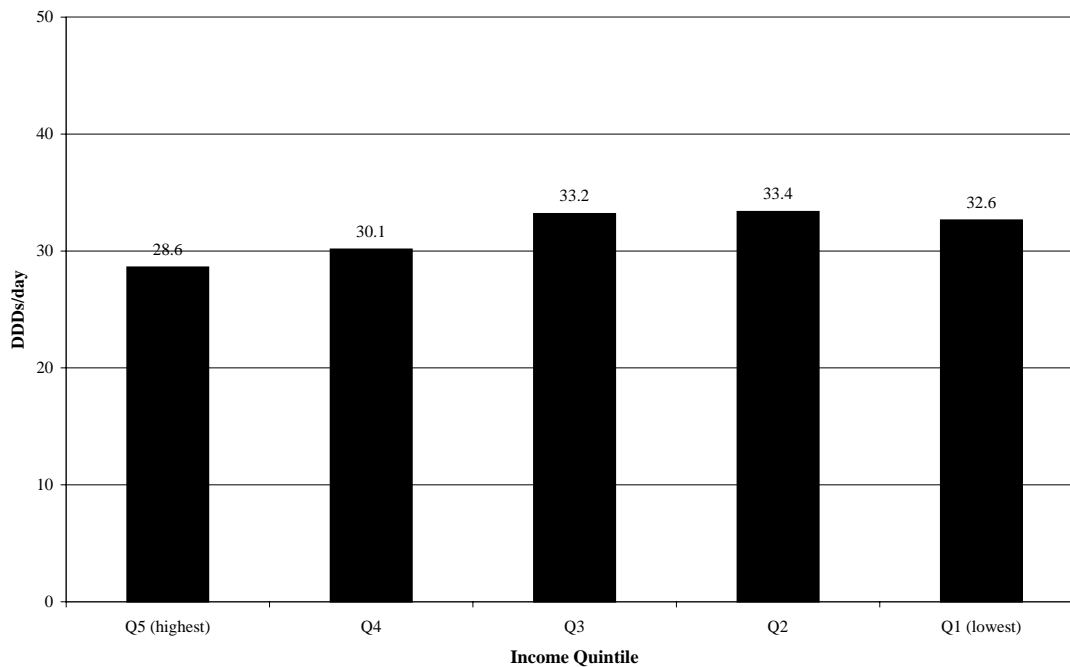
**Figure 39: Intensity of Use (#DDDs/1000 residents) Per Day
ACE Inhibitors by Age/Sex**



**Figure 40: Intensity of Use (#DDDs/1000 residents) Per Day
ACE Inhibitors by Region**



**Figure 41: Intensity of Use (#DDDs/1000 residents) Per Day
ACE Inhibitors by Income Quintile**



**Figure 42: Expenditures (\$/resident) Per Year
ACE Inhibitors by Age/Sex**

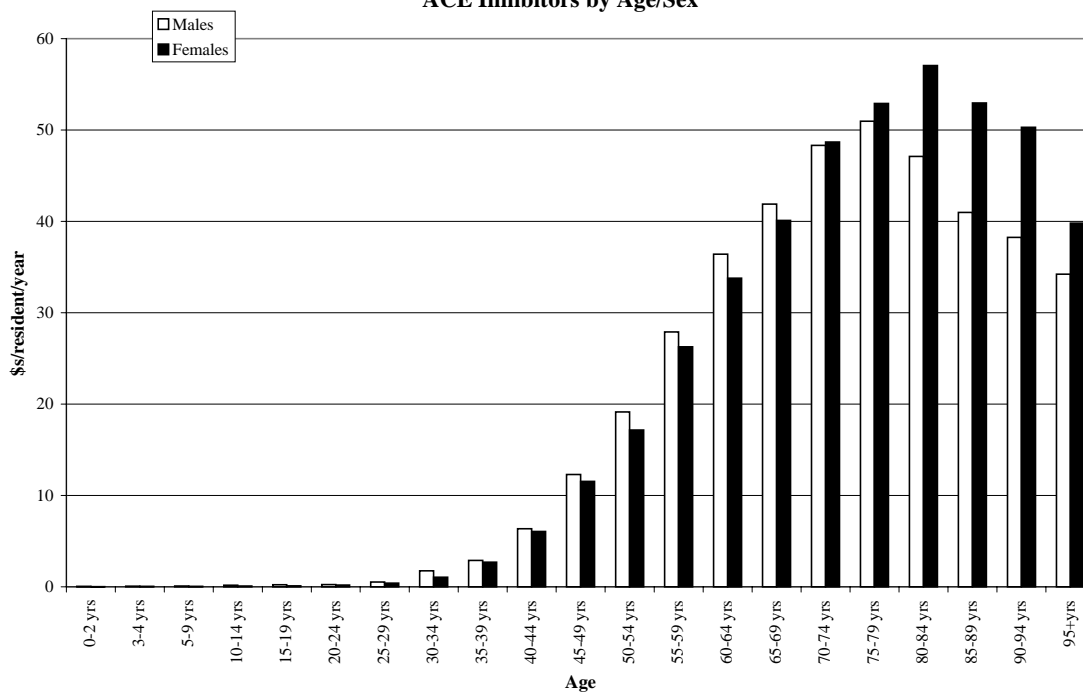


Figure 43: Expenditures (\$/resident) Per Year ACE Inhibitors by Region

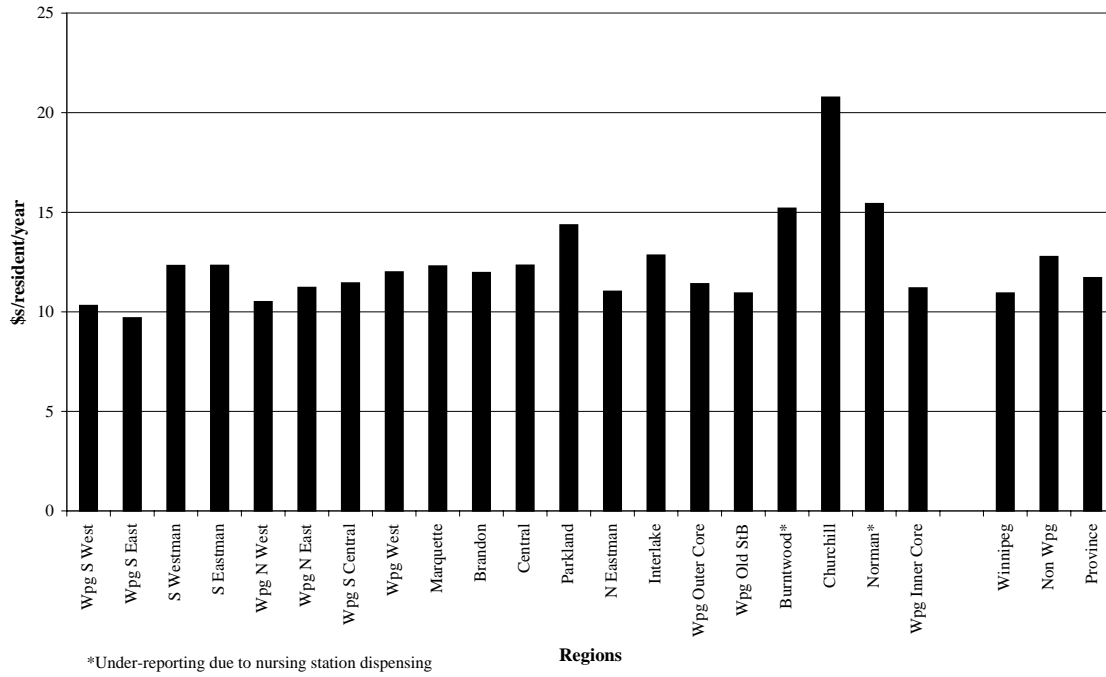
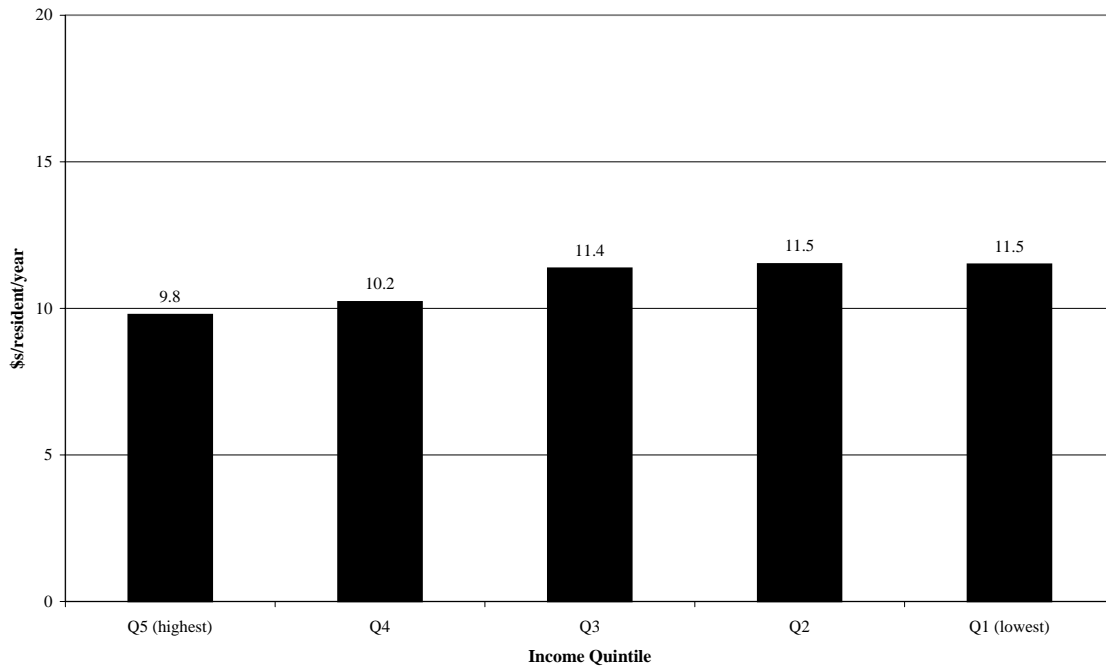
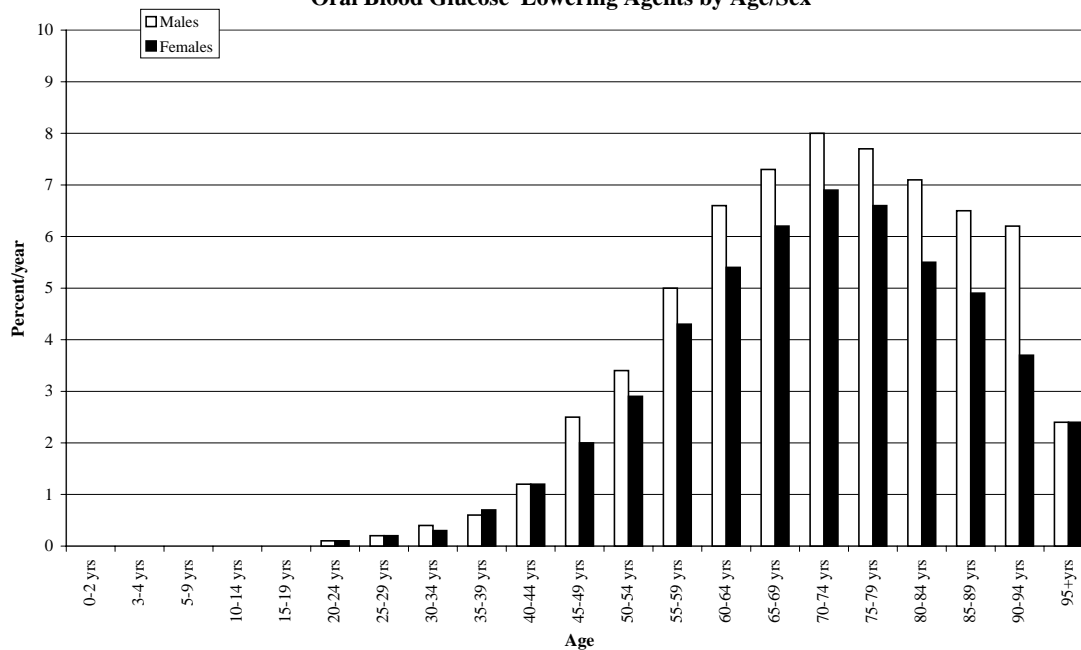


Figure 44: Expenditures (\$/resident) Per Year ACE Inhibitors by Income Quintile

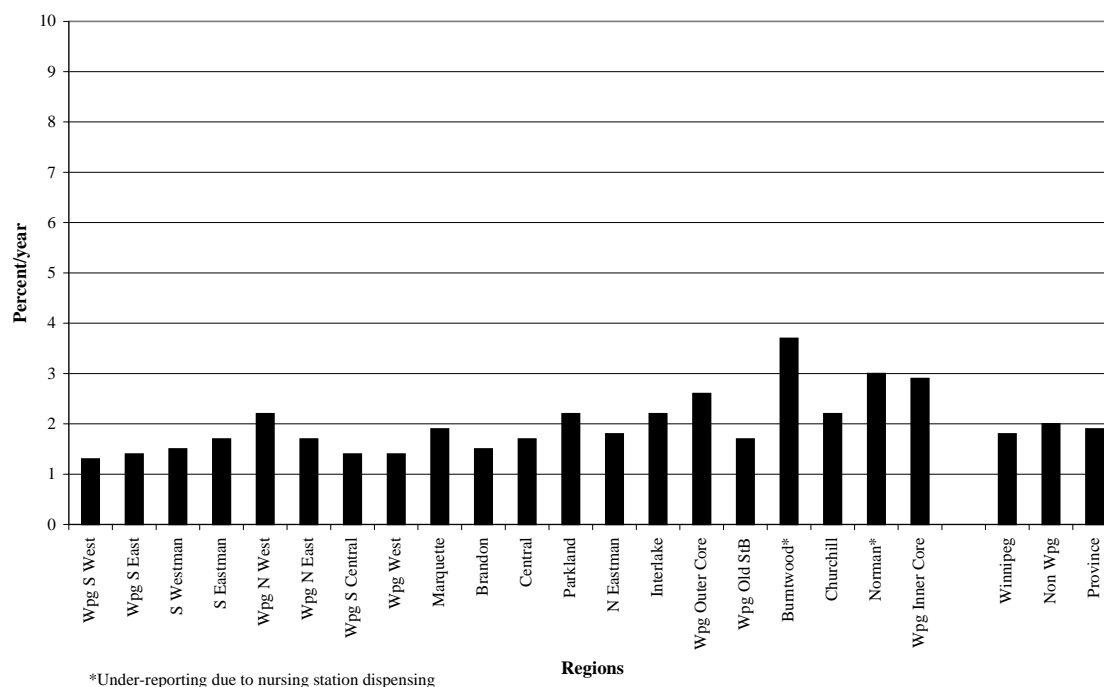


ORAL BLOOD GLUCOSE LOWERING AGENTS

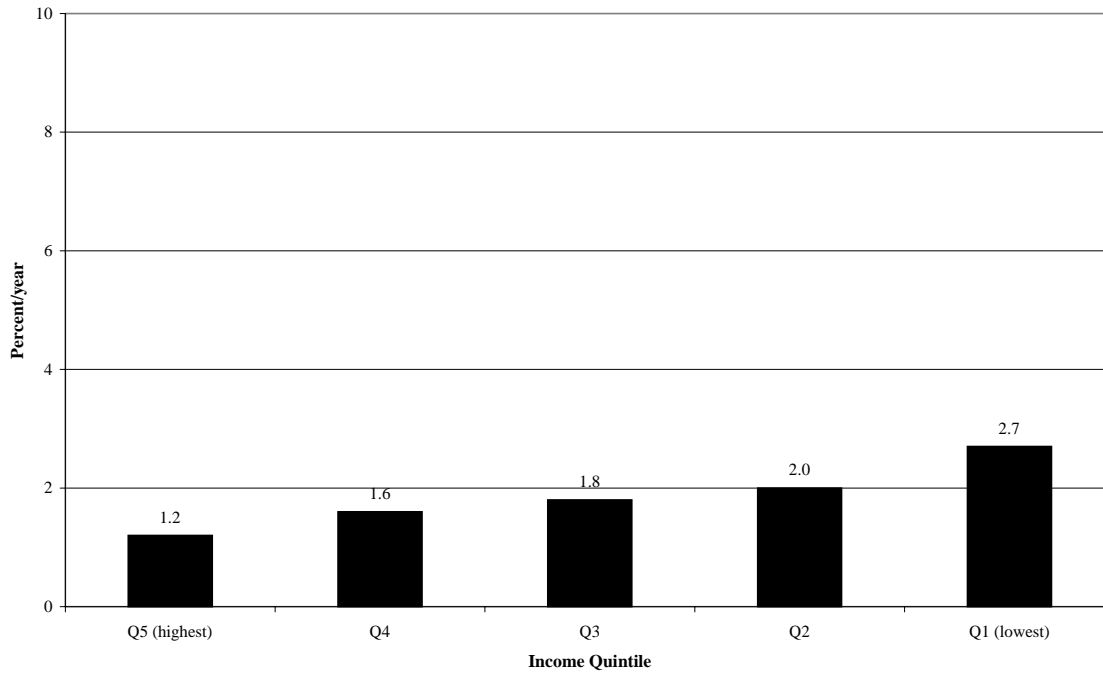
**Figure 45: Access (to at least one prescription) Per Year
Oral Blood Glucose Lowering Agents by Age/Sex**



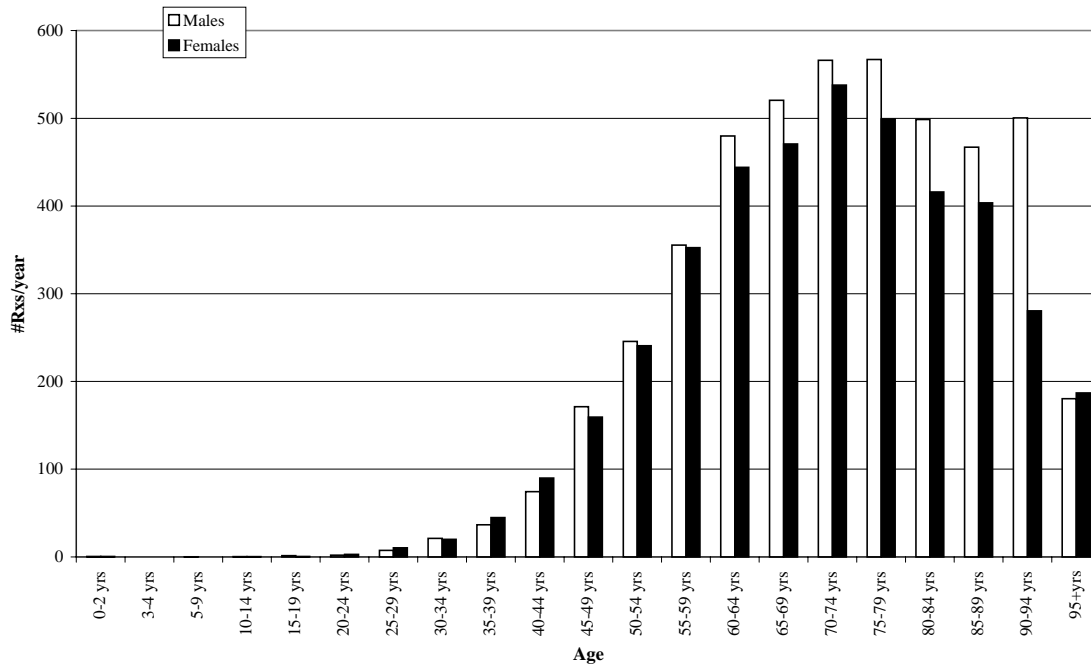
**Figure 46: Access (to at least one prescription) Per Year
Oral Blood Glucose Lowering Agents by Region**



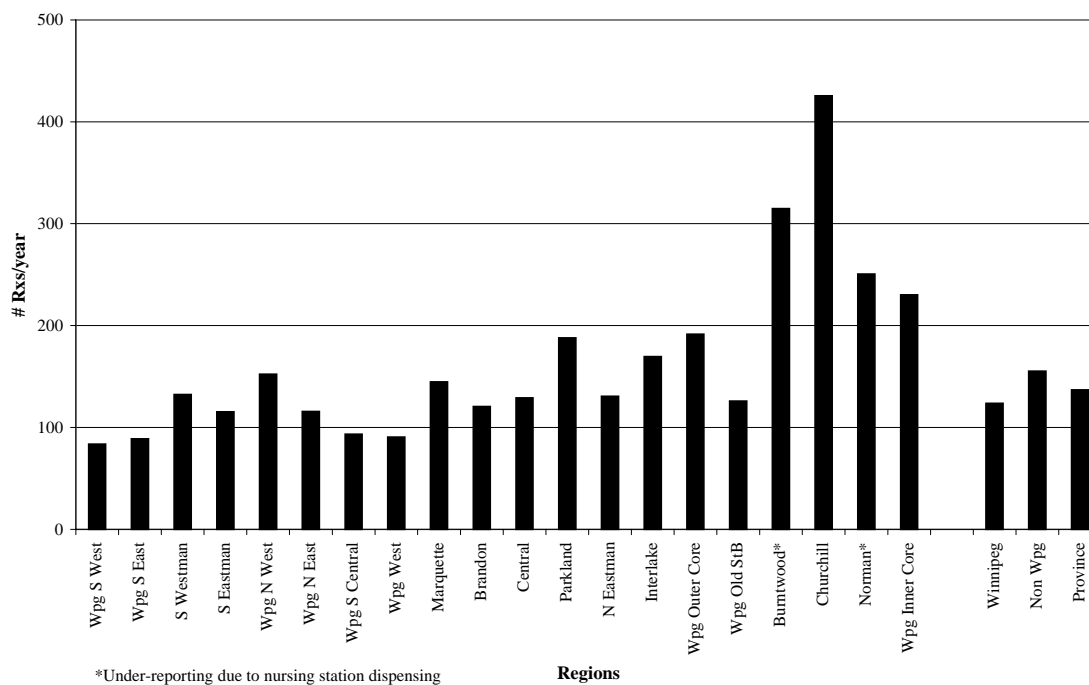
**Figure 47: Access (to at least one prescription) Per Year
Oral Blood Glucose Lowering Agents by Income Quintile**



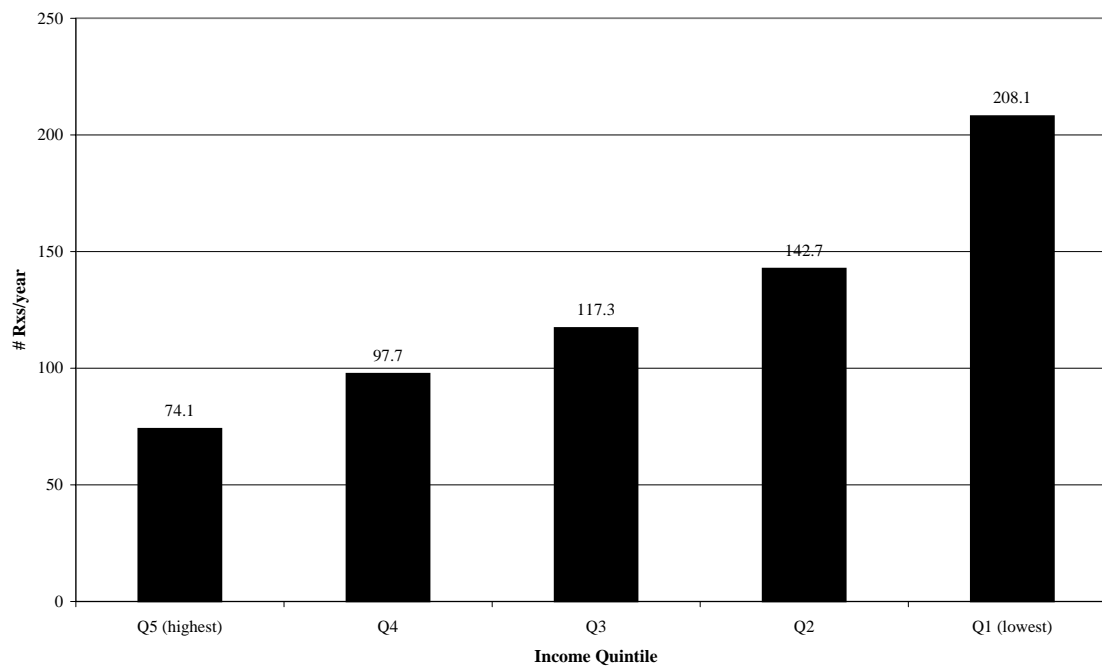
**Figure 48: Intensity of Use (# prescriptions/1000 residents) Per Year
Oral Blood Glucose Lowering Agents by Age/Sex**



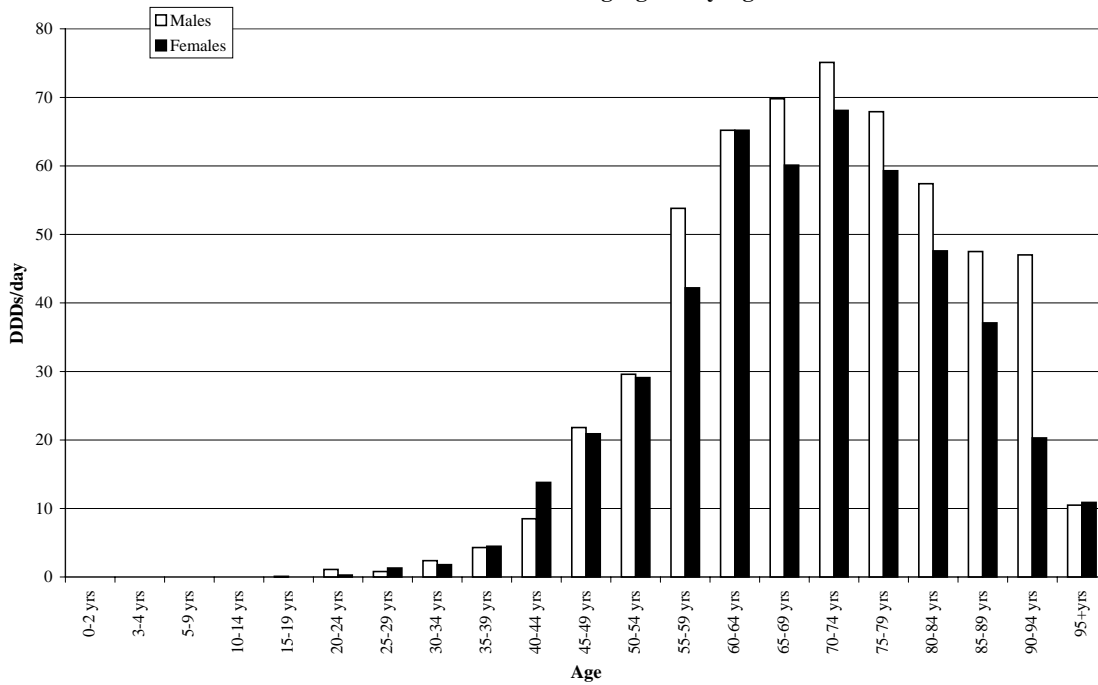
**Figure 49: Intensity of Use (# prescriptions/1000 residents) Per Year
Oral Blood Glucose Lowering Agents by Region**



**Figure 50: Intensity of Use (# prescriptions/1000 residents) Per Year
Oral Blood Glucose Lowering Agents by Income Quintile**



**Figure 51: Intensity of Use (#DDDs/1000 residents) Per Day
Oral Blood Glucose Lowering Agents by Age/Sex**



**Figure 52: Intensity of Use (#DDDs/1000 residents) Per Day
Oral Blood Glucose Lowering Agents by Region**

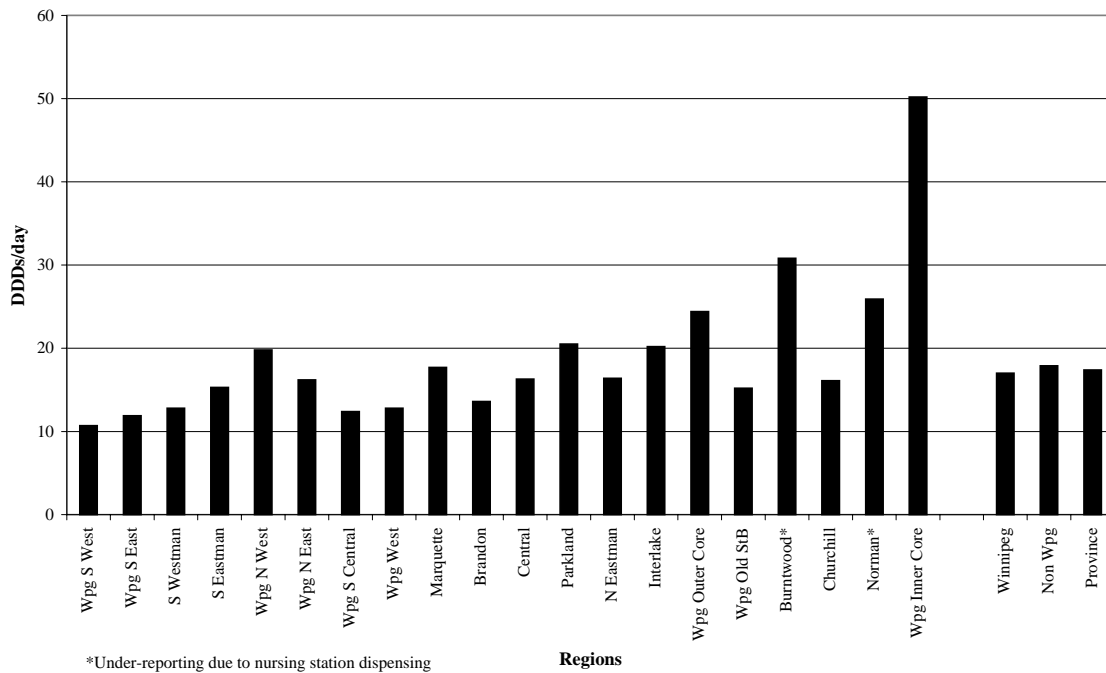


Figure 53: Intensity of Use (#DDDs/1000 residents) Per Day Oral Blood Glucose Lowering Agents by Income Quintile

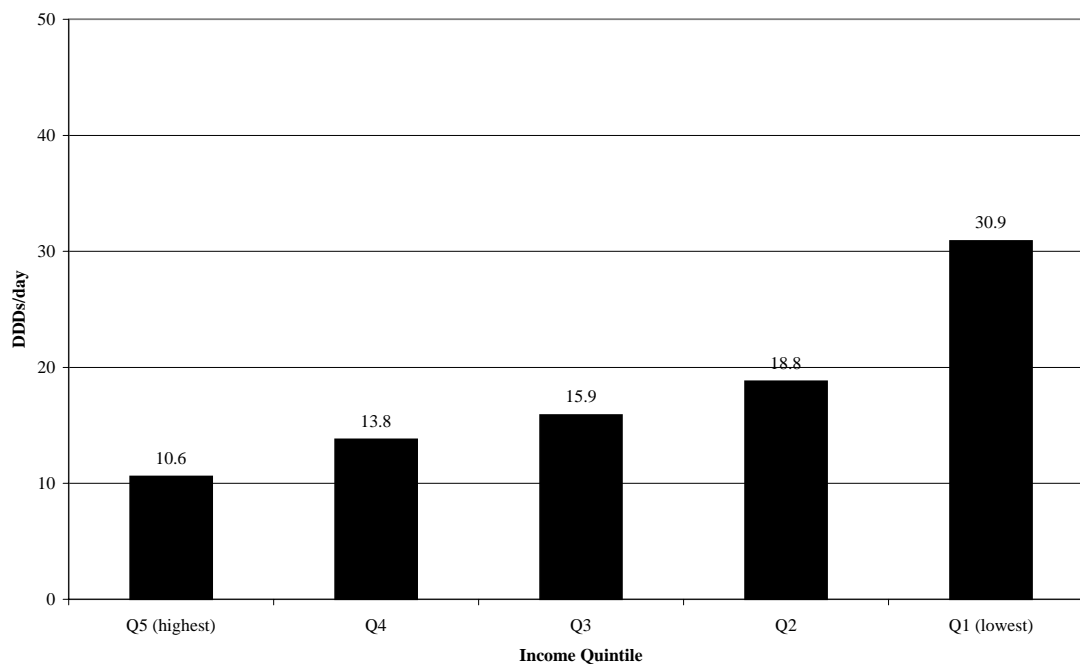
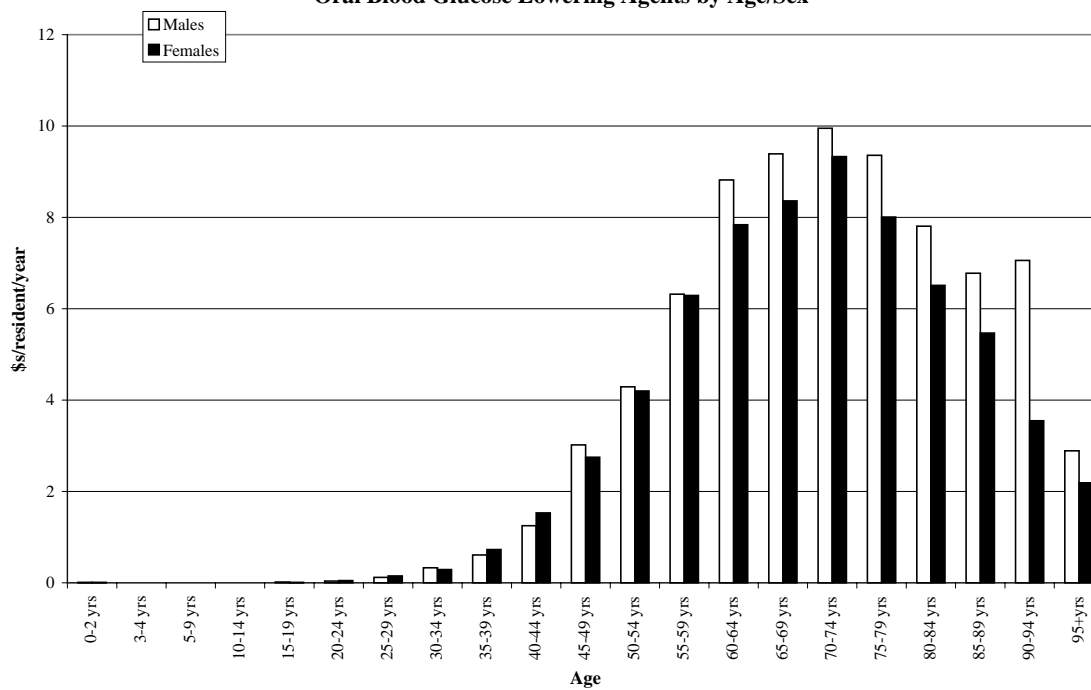
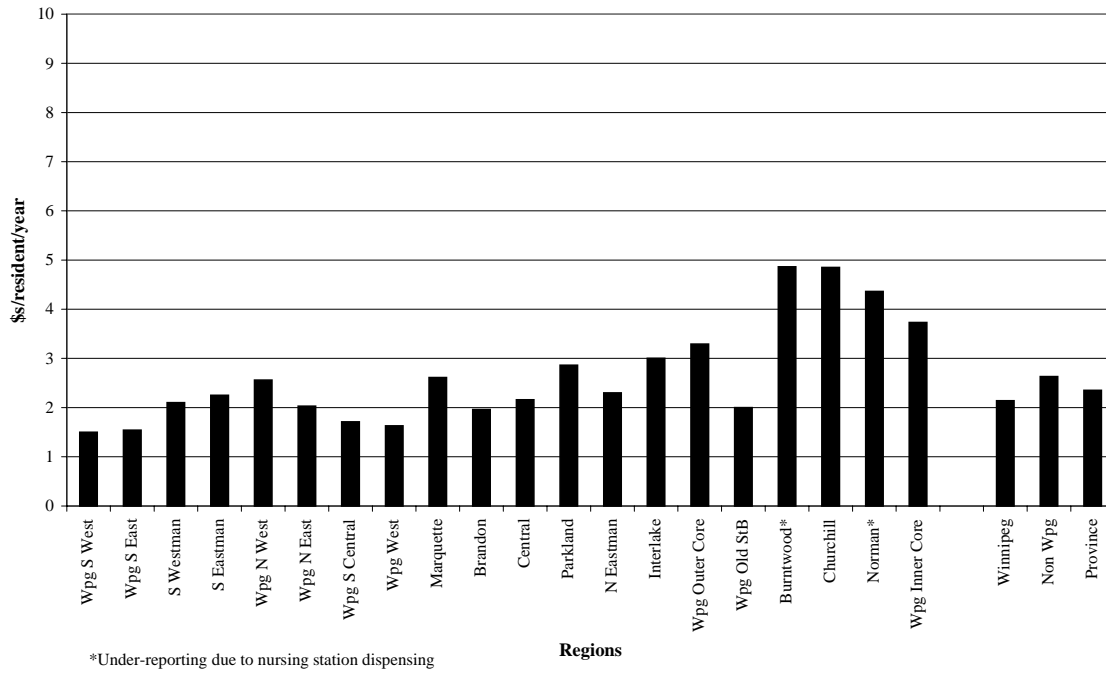


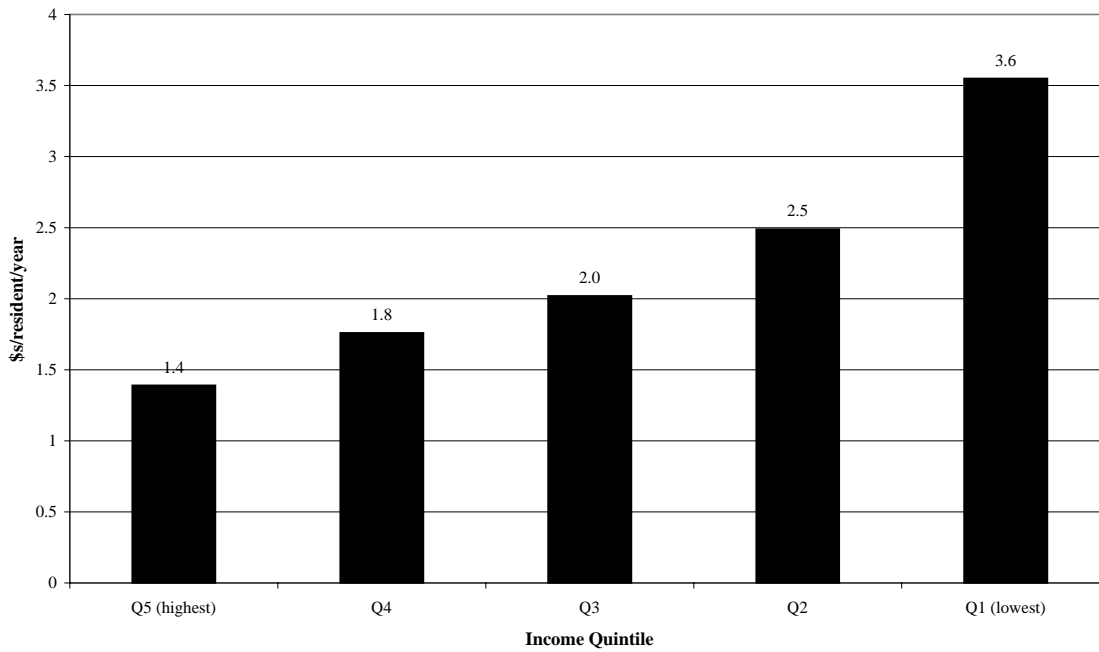
Figure 54: Expenditures (\$/resident) Per Year Oral Blood Glucose Lowering Agents by Age/Sex



**Figure 55: Expenditures (\$/resident) Per Year
Oral Blood Glucose Lowering Agents by Region**

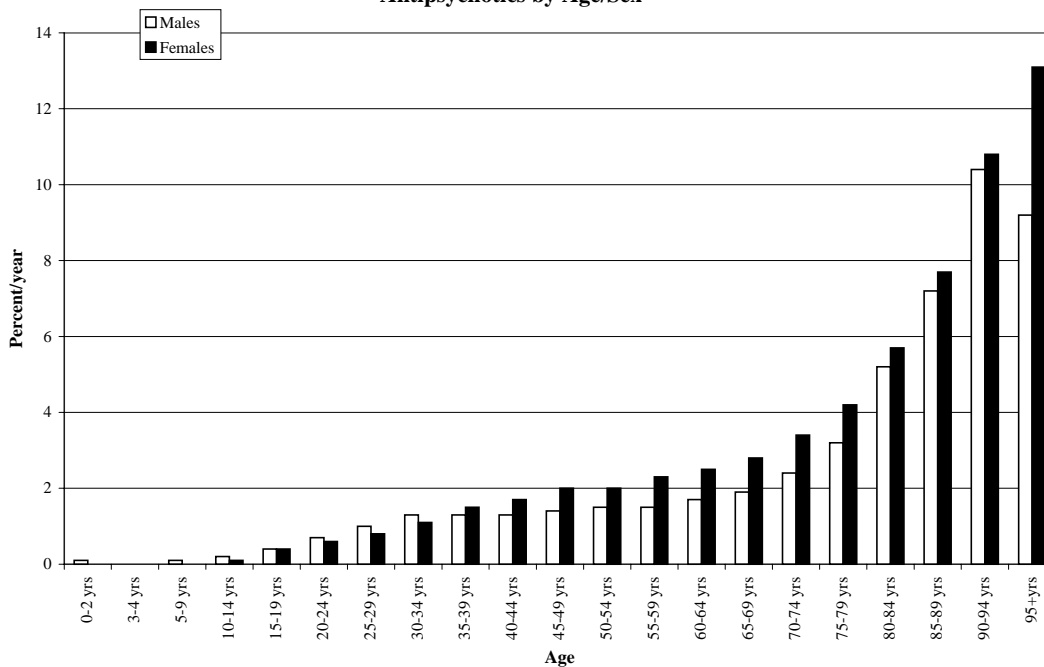


**Figure 56: Expenditures (\$/resident) Per Year
Oral Blood Glucose Lowering Agents by Income Quintile**



NERVOUS SYSTEM: ANTIPSYCHOTICS

**Figure 57: Access (to at least one prescription) Per Year
Antipsychotics by Age/Sex**



**Figure 58: Access (to at least one prescription) Per Year
Antipsychotics by Region**

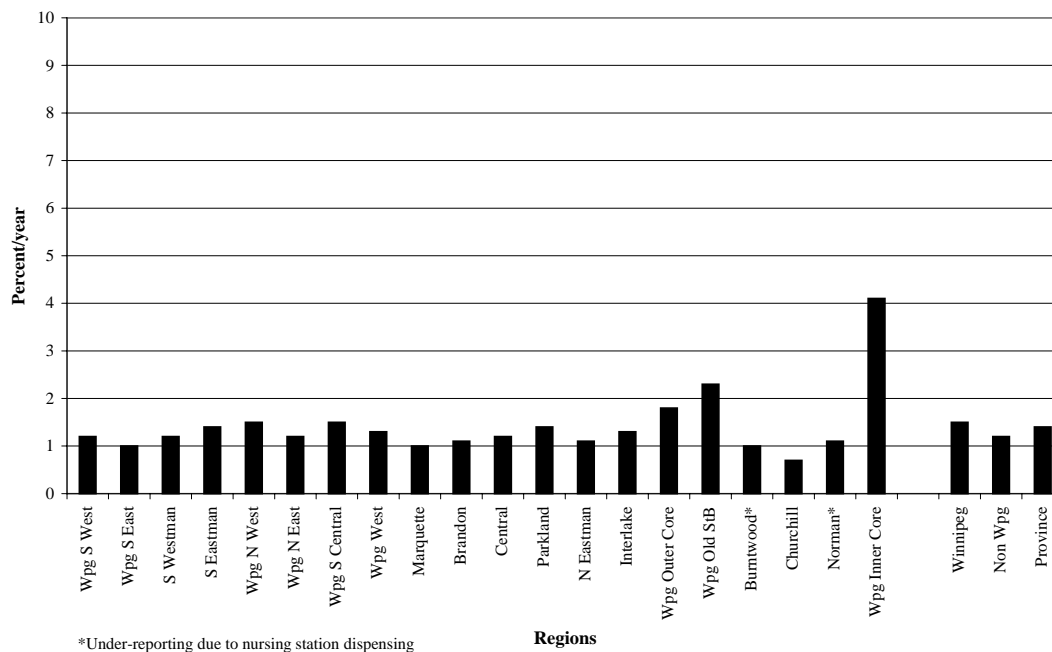


Figure 59: Access (to at least one prescription) Per Year Antipsychotics by Income Quintile

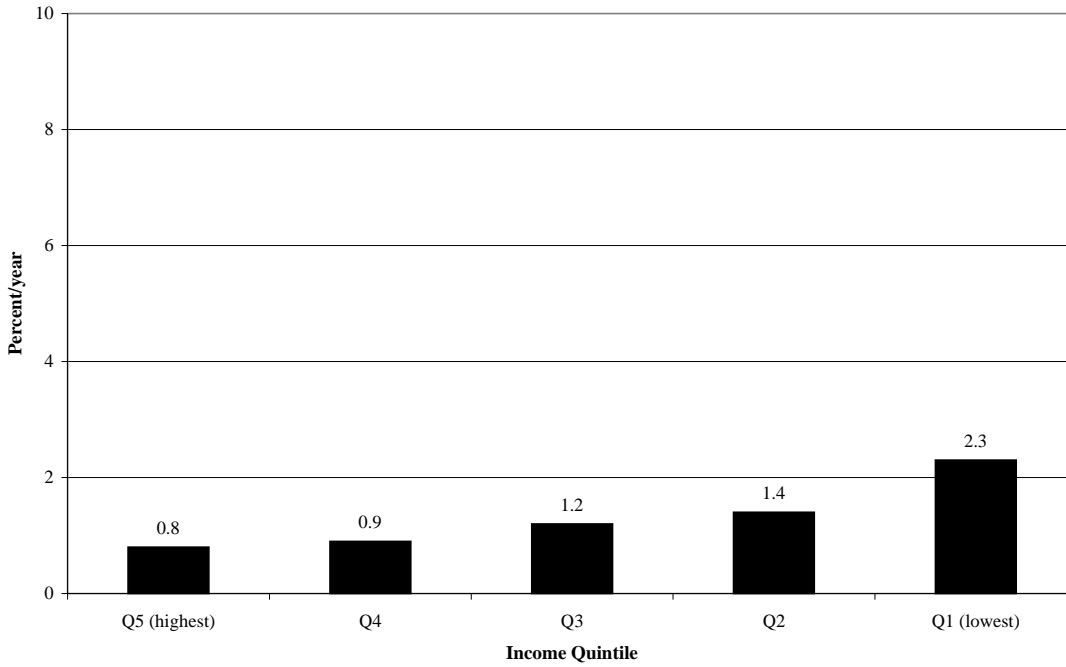
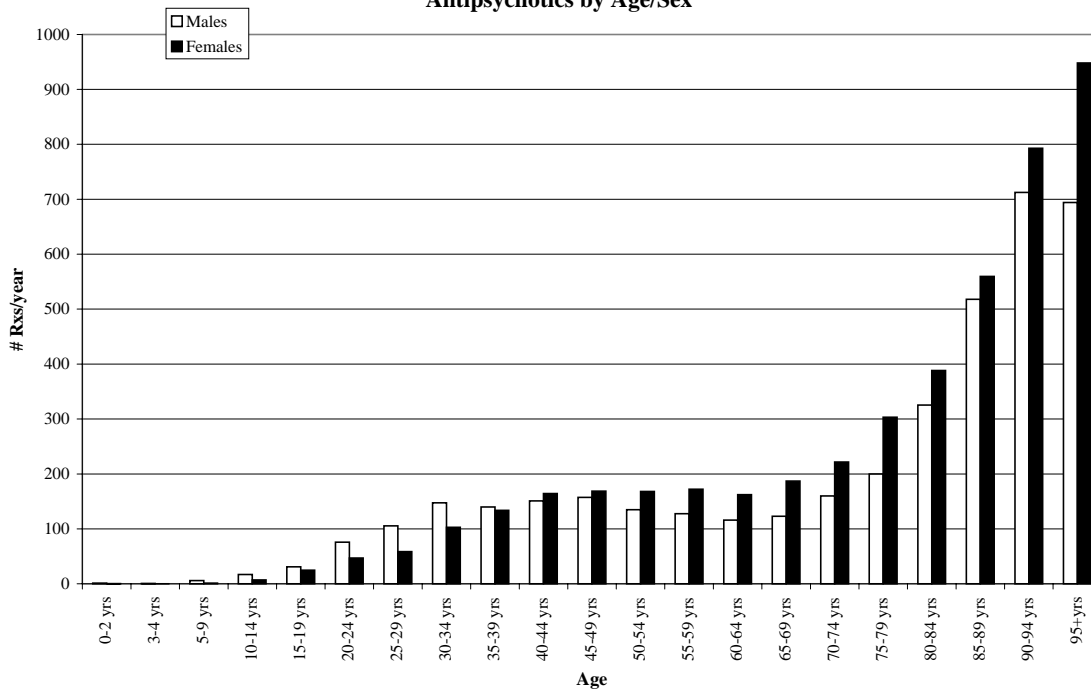
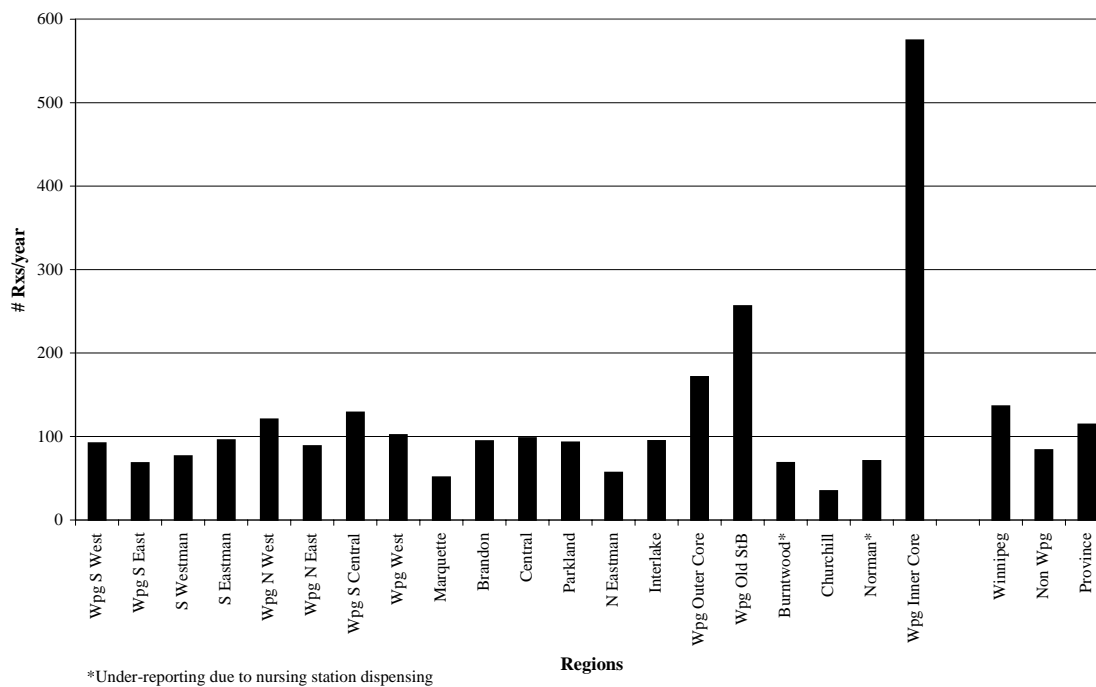


Figure 60: Intensity of Use (# prescriptions/1000 residents) Per Year Antipsychotics by Age/Sex



**Figure 61: Intensity of Use (# prescriptions/1000 residents) Per Year
Antipsychotics by Region**



**Figure 62: Intensity of Use (# prescriptions/1000 residents) Per Year
Antipsychotics by Income Quintile**

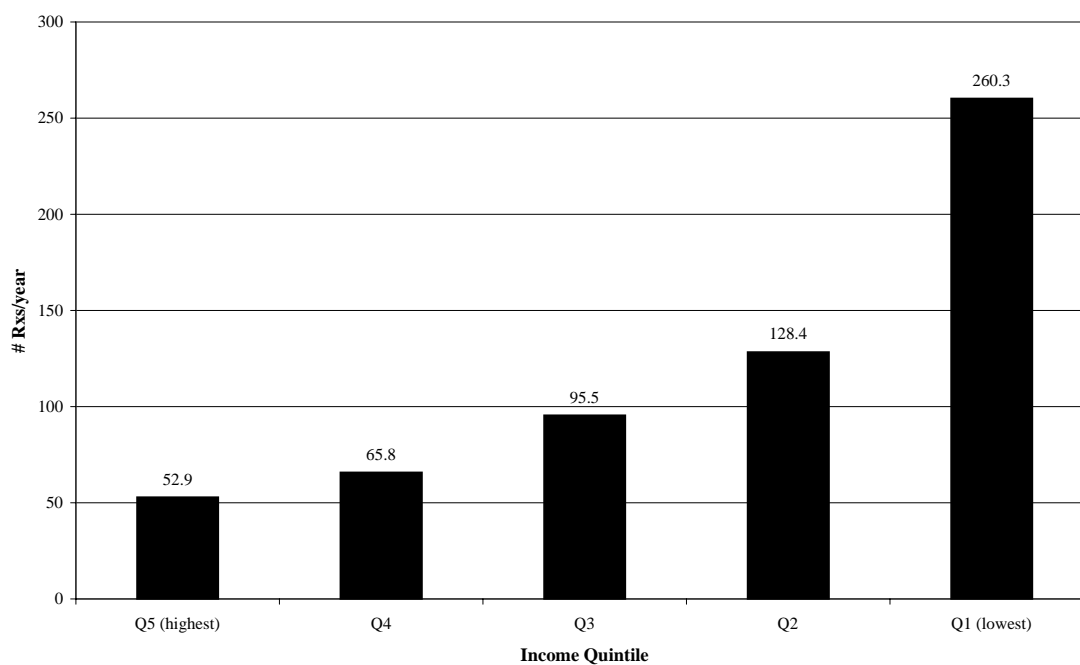


Figure 63: Intensity of Use (#DDDs/1000 residents) Per Day Antipsychotics by Age/Sex

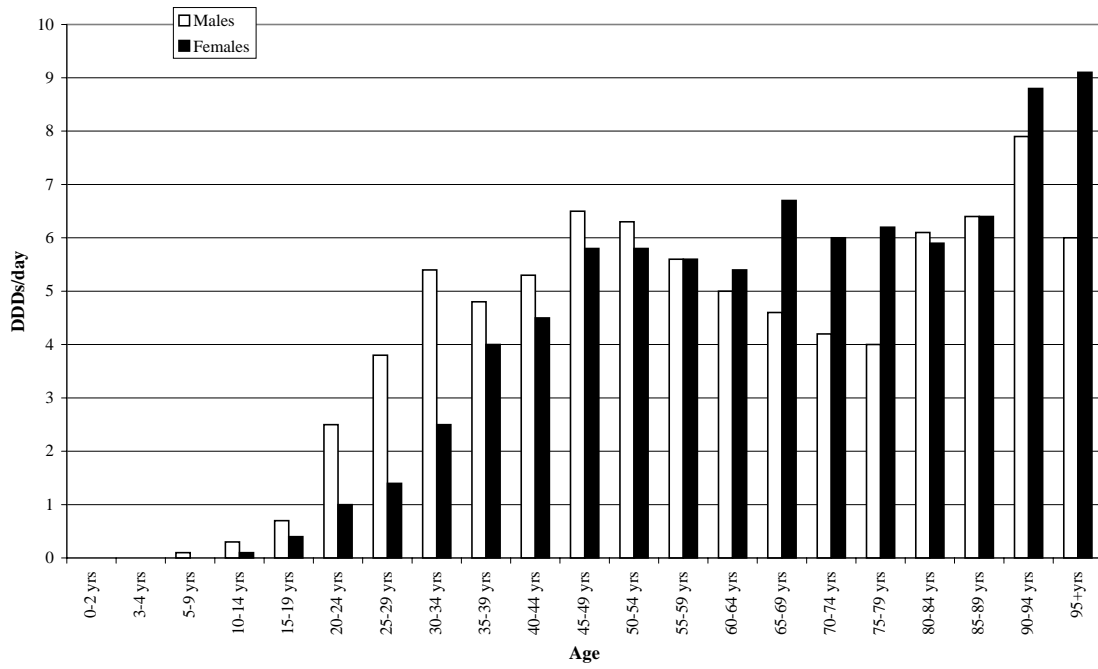


Figure 64: Intensity of Use (#DDDs/1000 residents) Per Day Antipsychotics by Region

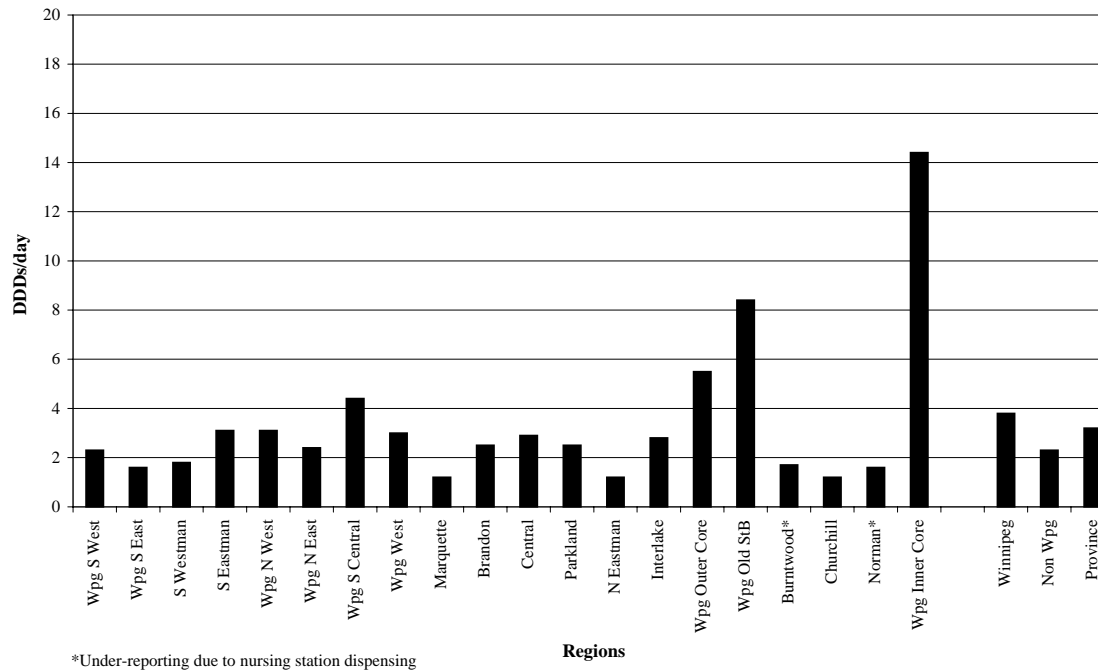


Figure 65: Intensity of Use (#DDDs/1000 residents) Per Day Antipsychotics by Income Quintile

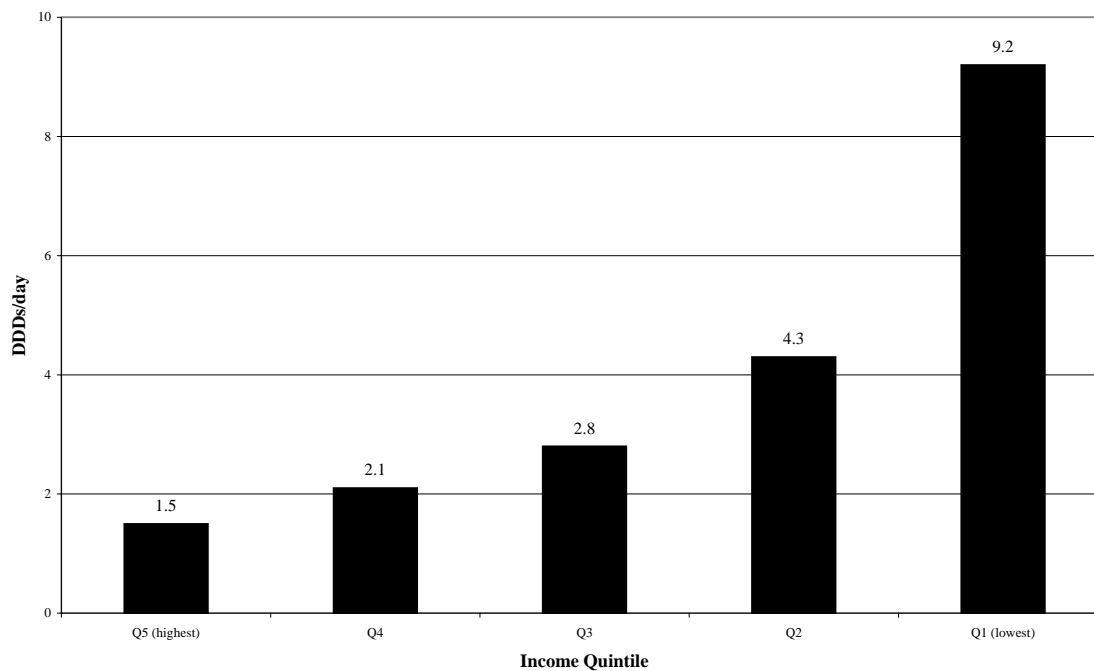


Figure 66: Expenditures (\$/resident) Per Year Antipsychotics by Age/Sex

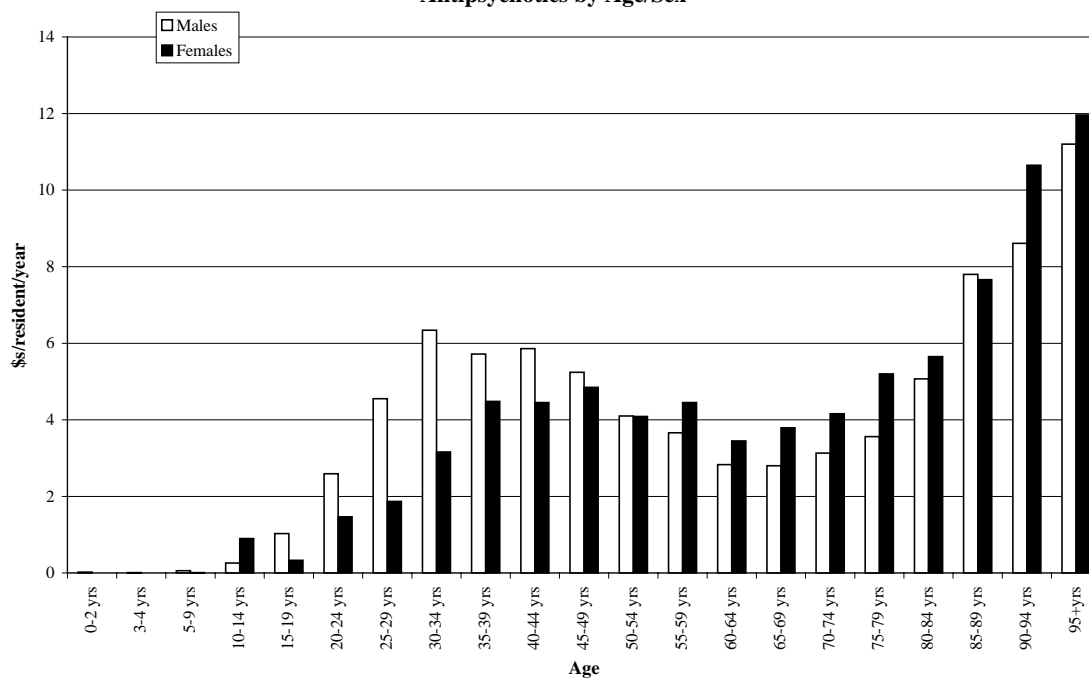


Figure 67: Expenditures (\$/resident) Per Year Antipsychotics by Region

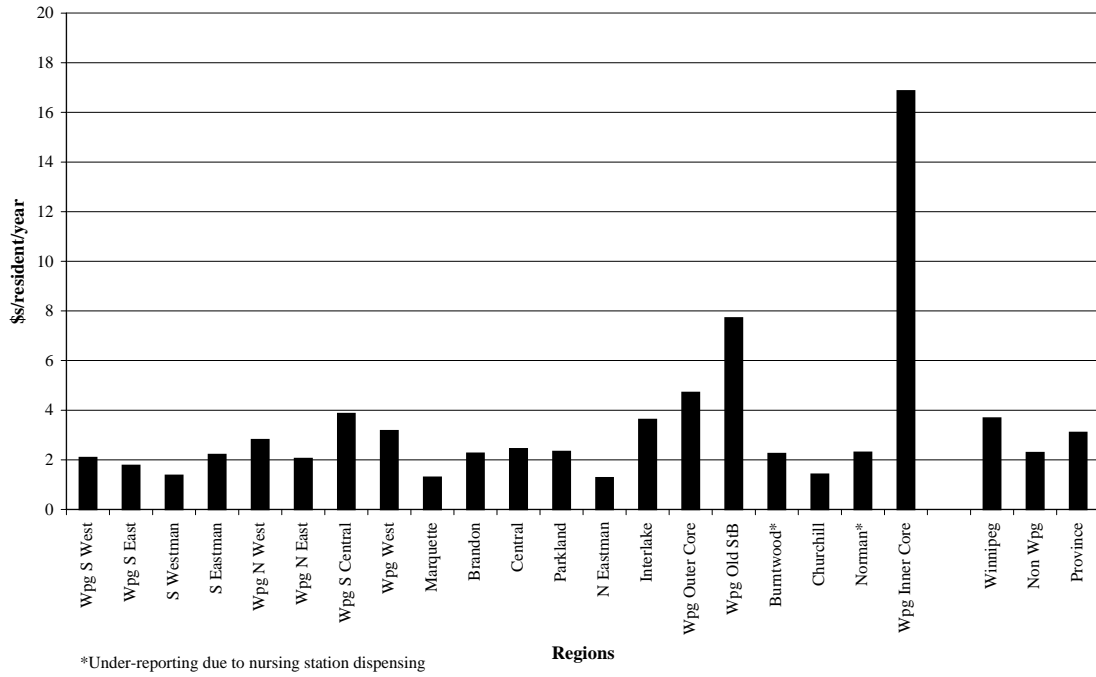
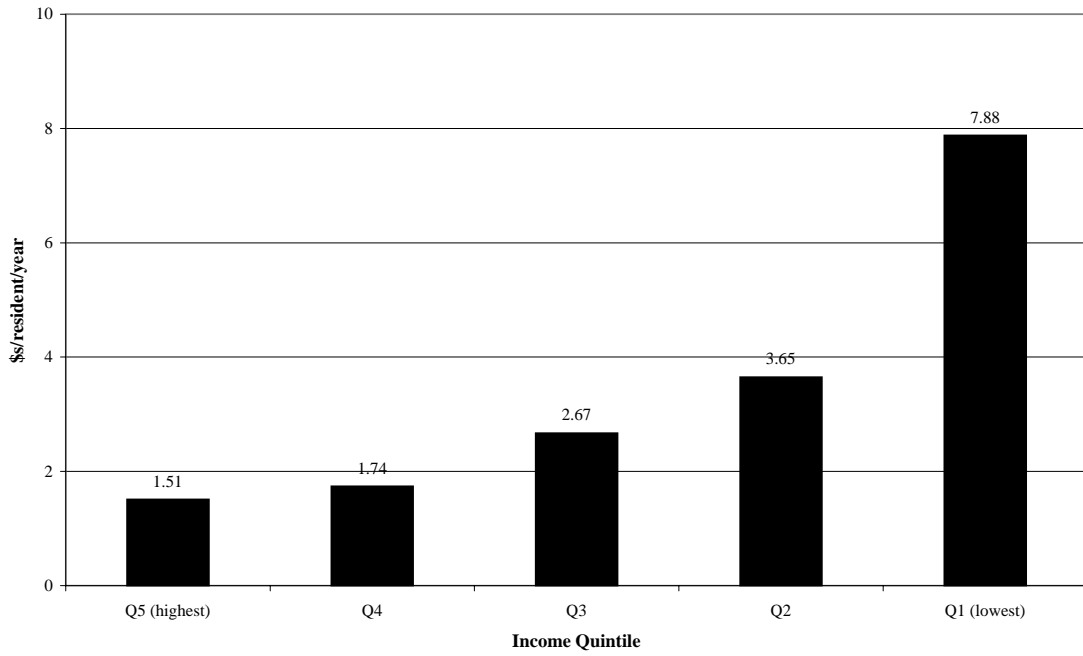
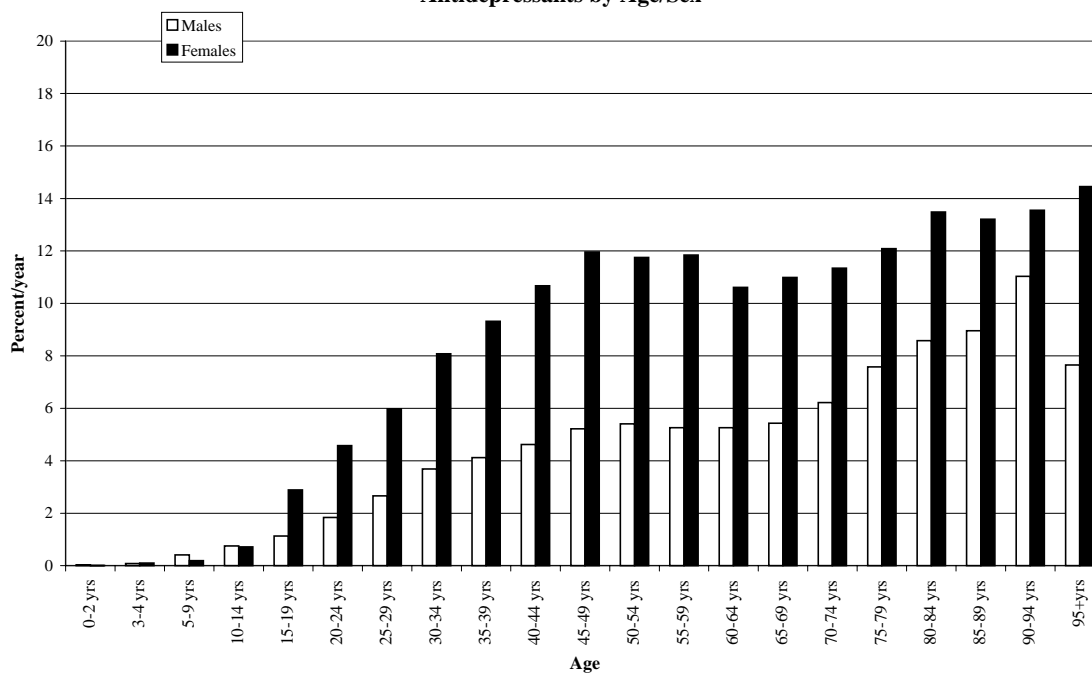


Figure 68: Expenditures (\$/resident) Per Year Antipsychotics by Income Quintile



NERVOUS SYSTEM: ANTIDEPRESSANTS

**Figure 69: Access (to at least one prescription) Per Year
Antidepressants by Age/Sex**



**Figure 70: Access (to at least one prescription) Per Year
Antidepressants by Region**

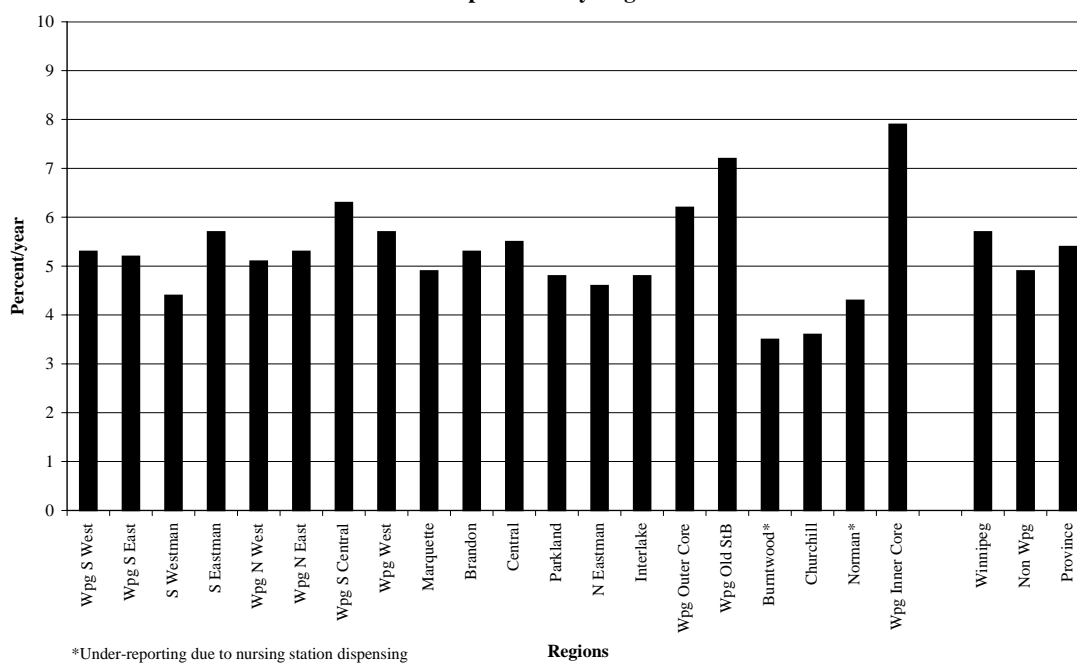


Figure 71: Access (to at least one prescription) Per Year Antidepressants by Income Quintile

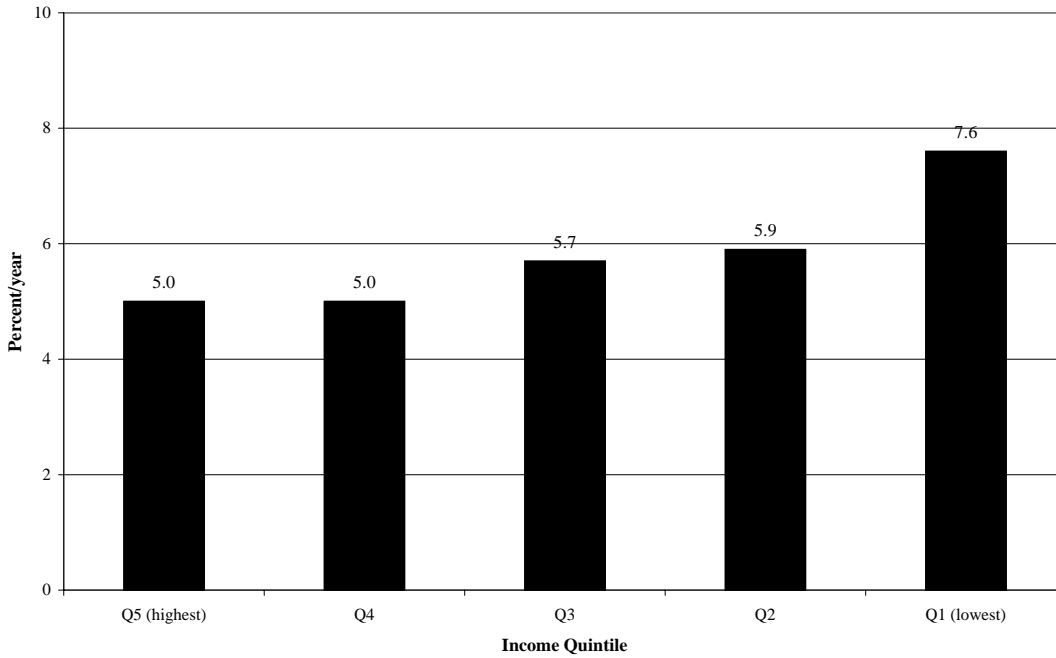


Figure 72: Intensity of Use (# prescriptions/1000 residents) Per Year Antidepressants by Age/Sex

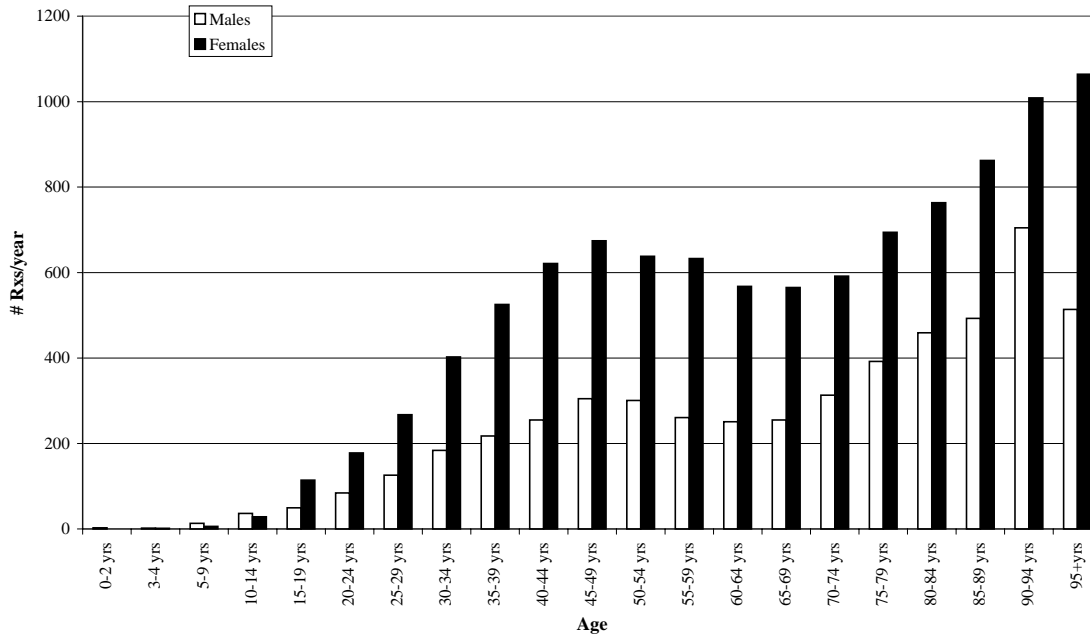
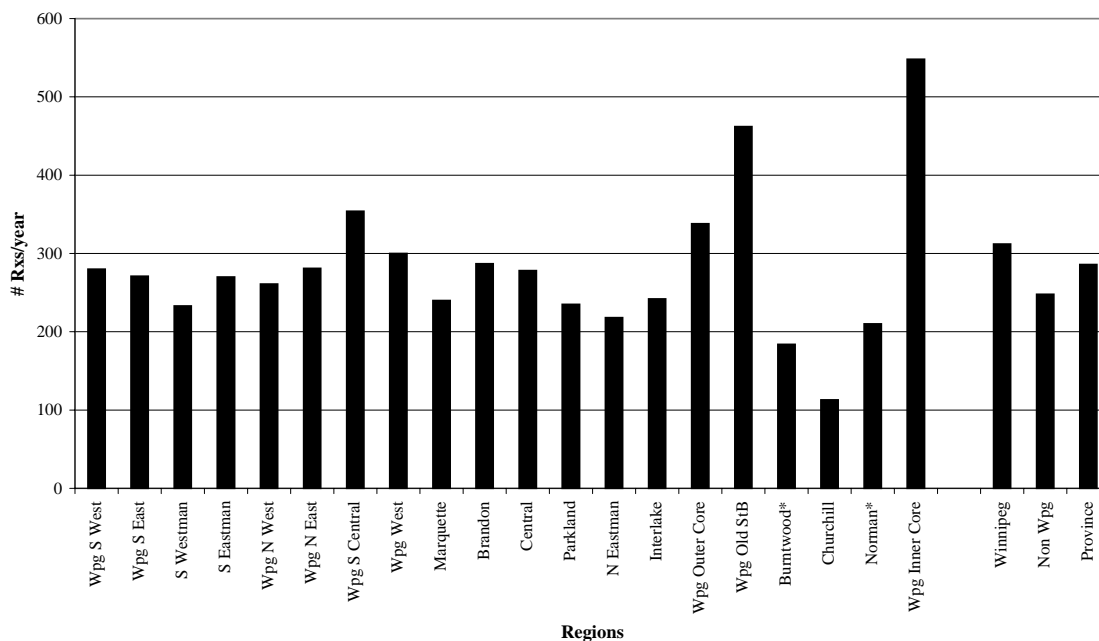


Figure 73: Intensity of Use (# prescriptions/1000 residents) Per Year Antidepressants by Region



*Under-reporting due to nursing station dispensing

Figure 74: Intensity of Use (# prescriptions/1000 residents) Per Year Antidepressants by Income Quintile

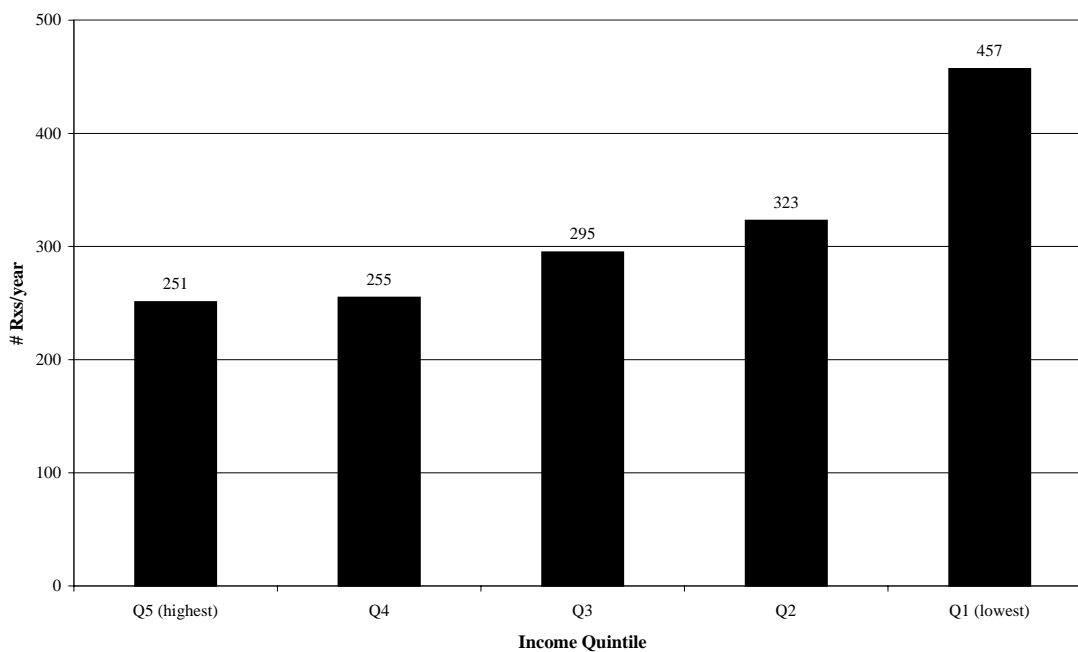


Figure 75: Intensity of Use (#DDD/1000 residents) Per Day Antidepressants by Age/Sex

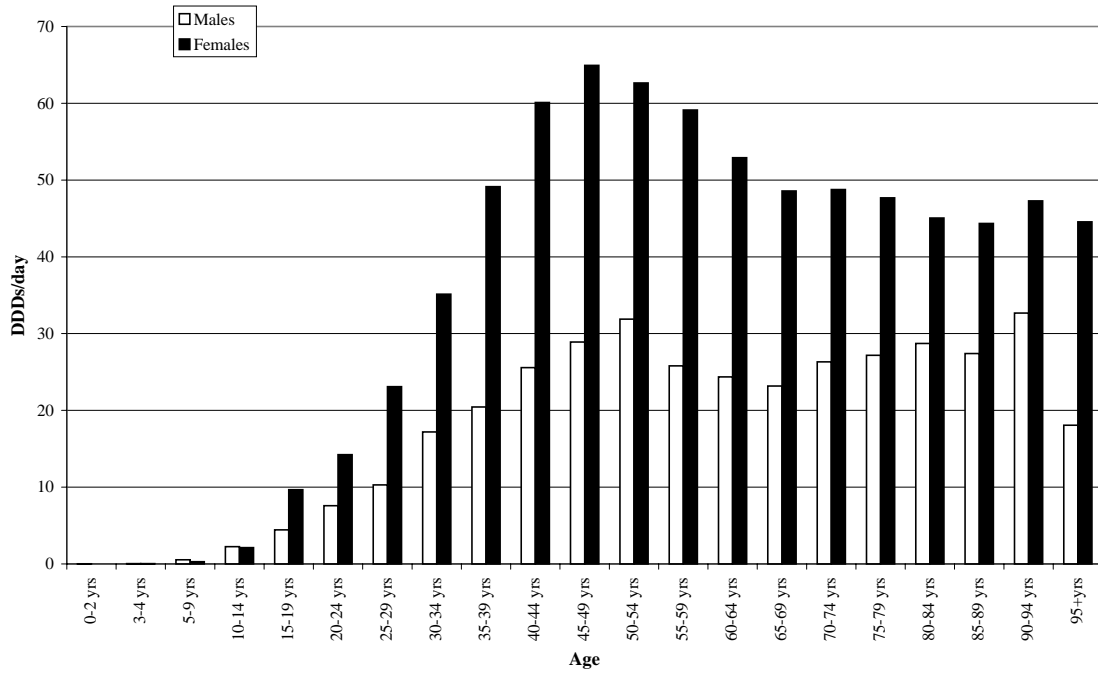


Figure 76: Intensity of Use (#DDD/1000 residents) Per Day Antidepressants by Region

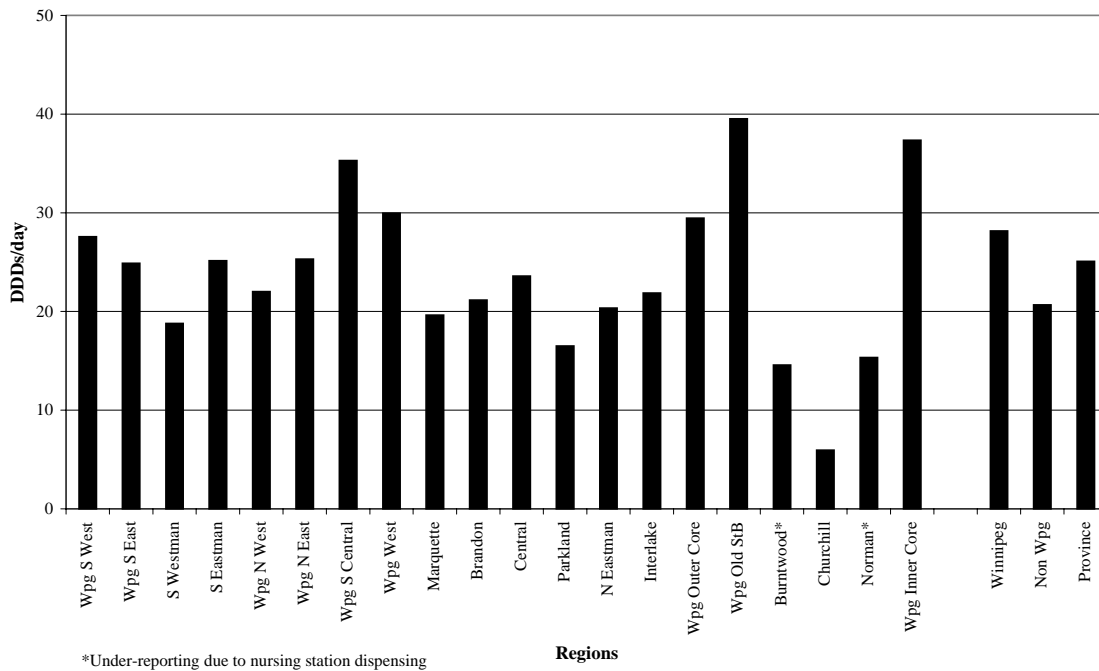


Figure 77: Intensity of Use (#DDDs/1000 residents) Per Day Antidepressants by Income Quintile

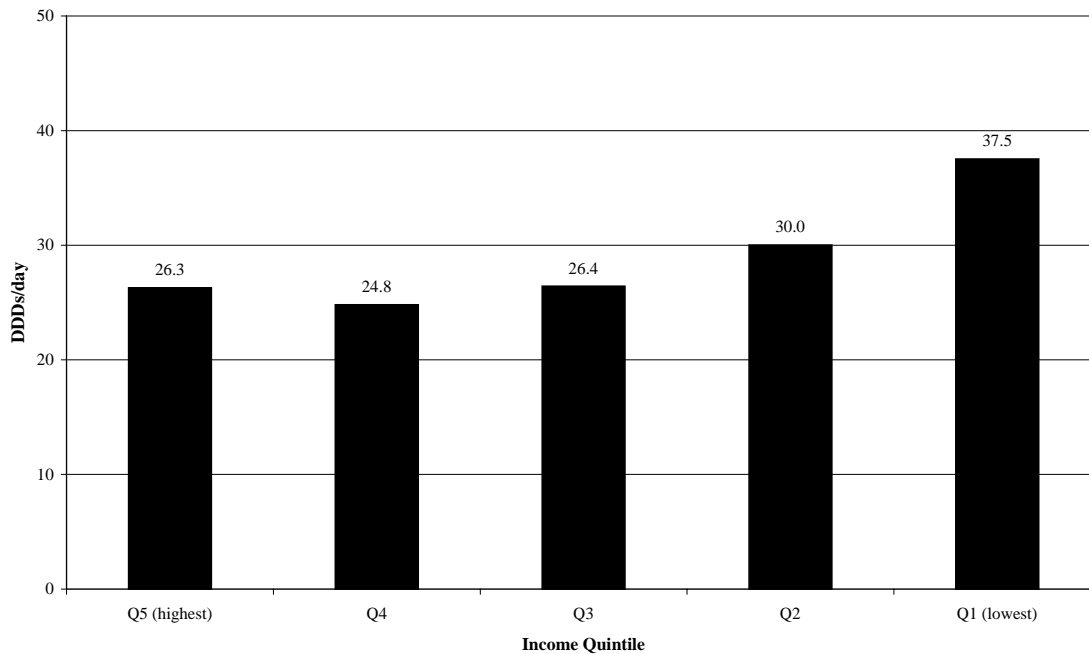


Figure 78: Expenditures (\$/resident) Per Year Antidepressants by Age/Sex

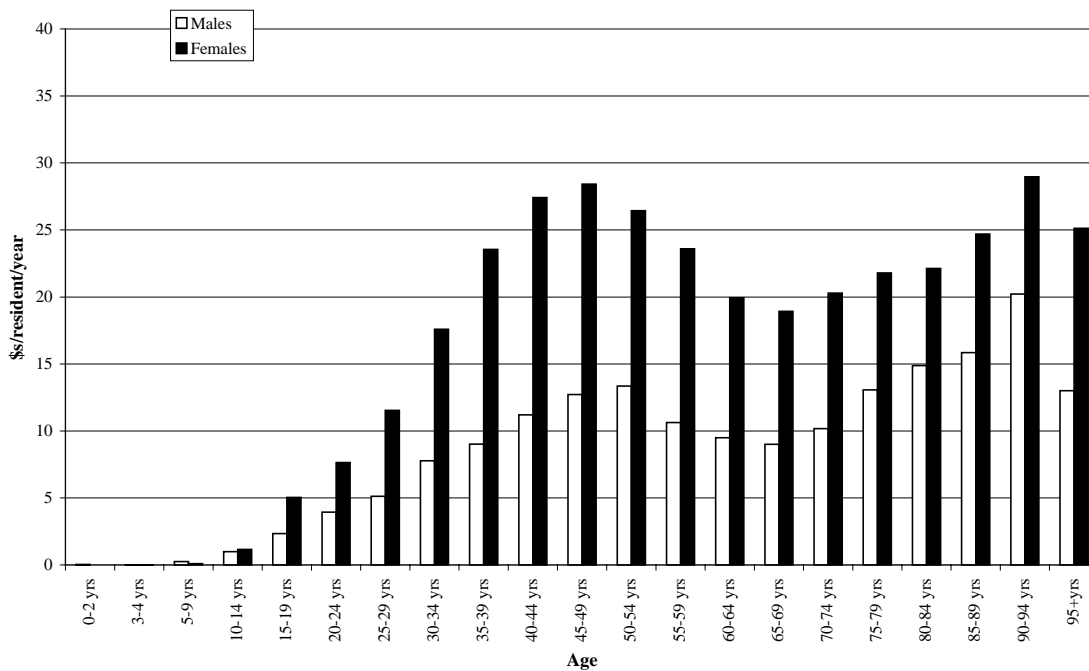


Figure 79: Expenditures (\$/resident) Per Year Antidepressants by Region

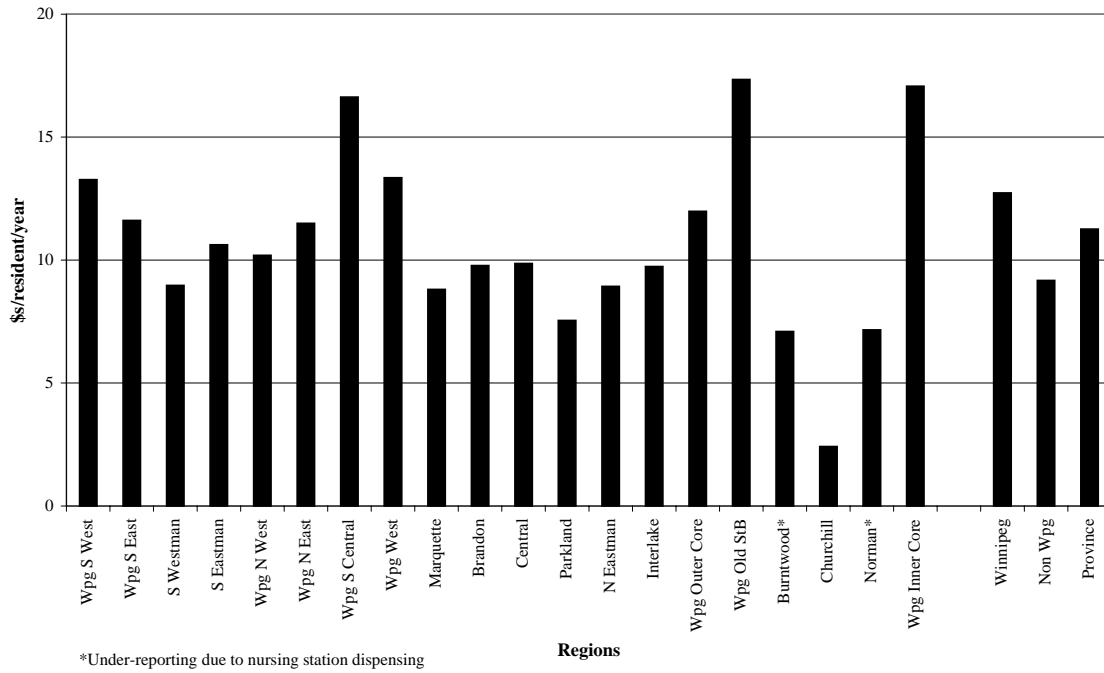
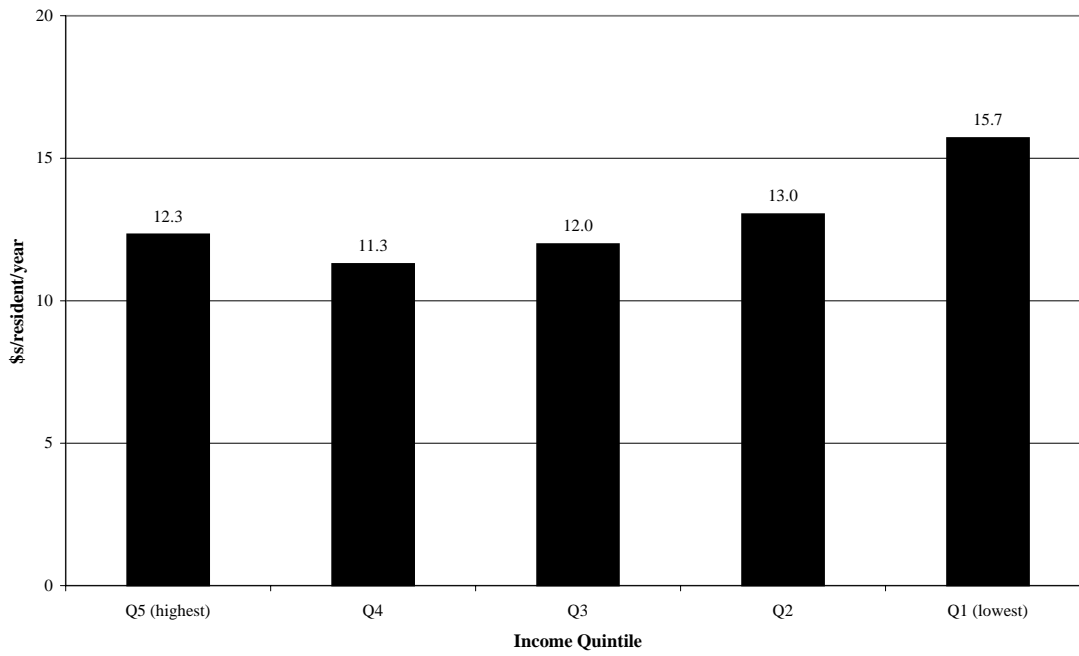
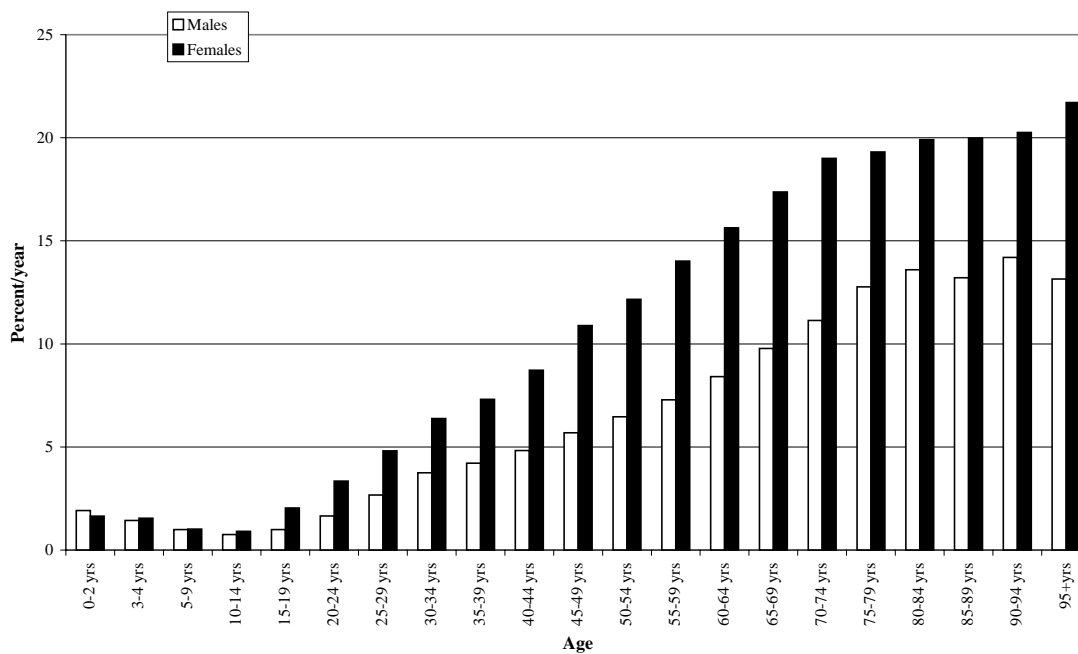


Figure 80: Expenditures (\$/resident) Per Year Antidepressants by Income Quintile

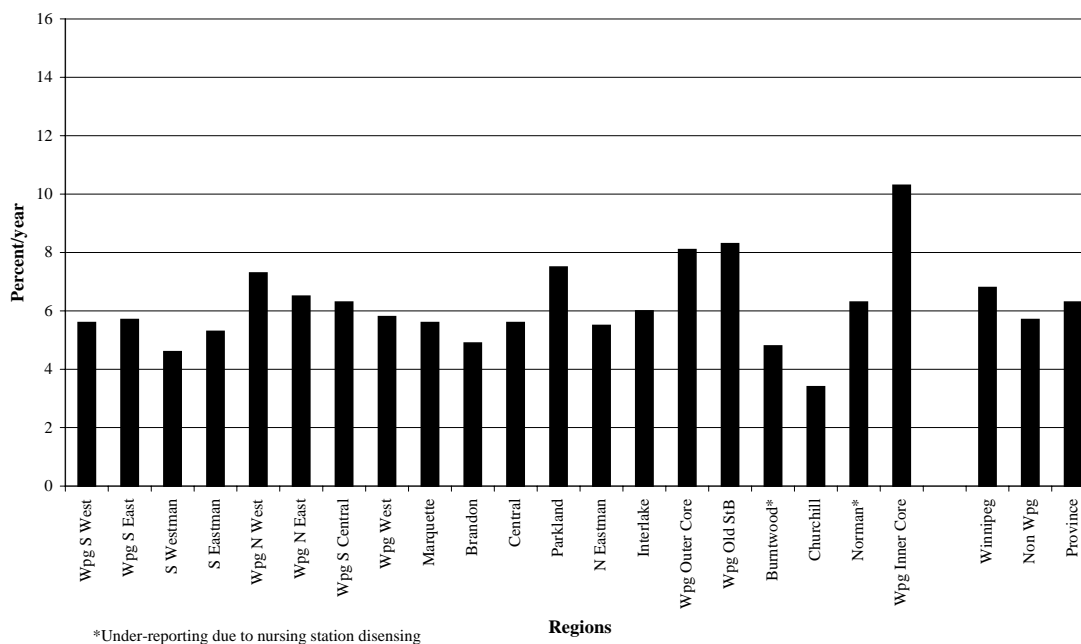


NERVOUS SYSTEM: ANXIOLYTICS

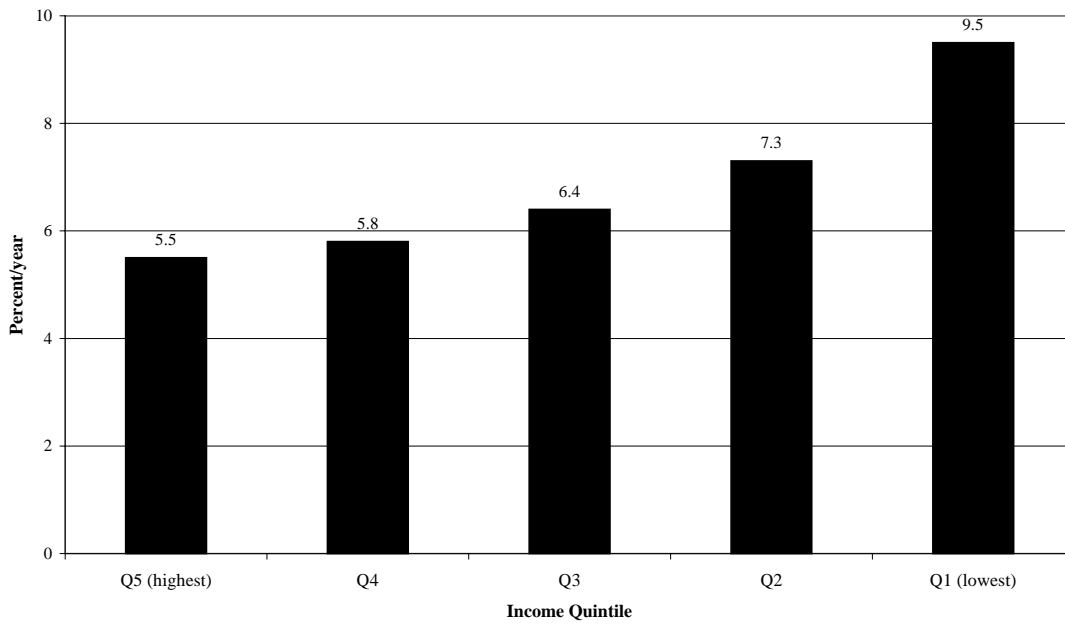
**Figure 81: Access (to at least one prescription) Per Year
Anxiolytics by Age/Sex**



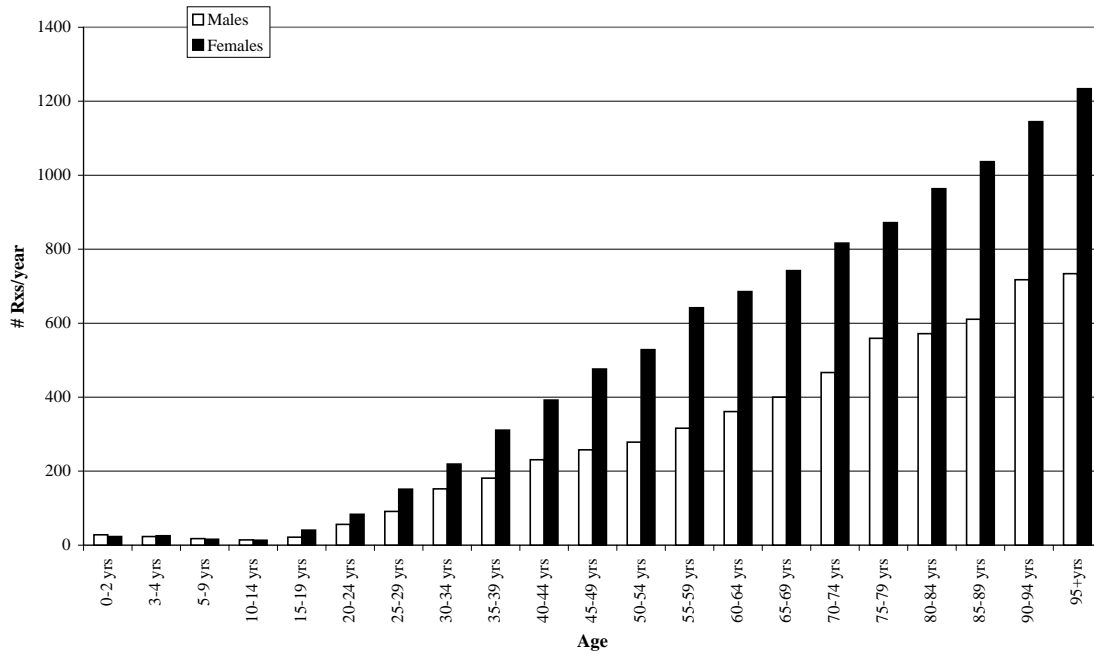
**Figure 82: Access (to at least one prescription) Per Year
Anxiolytics by Region**



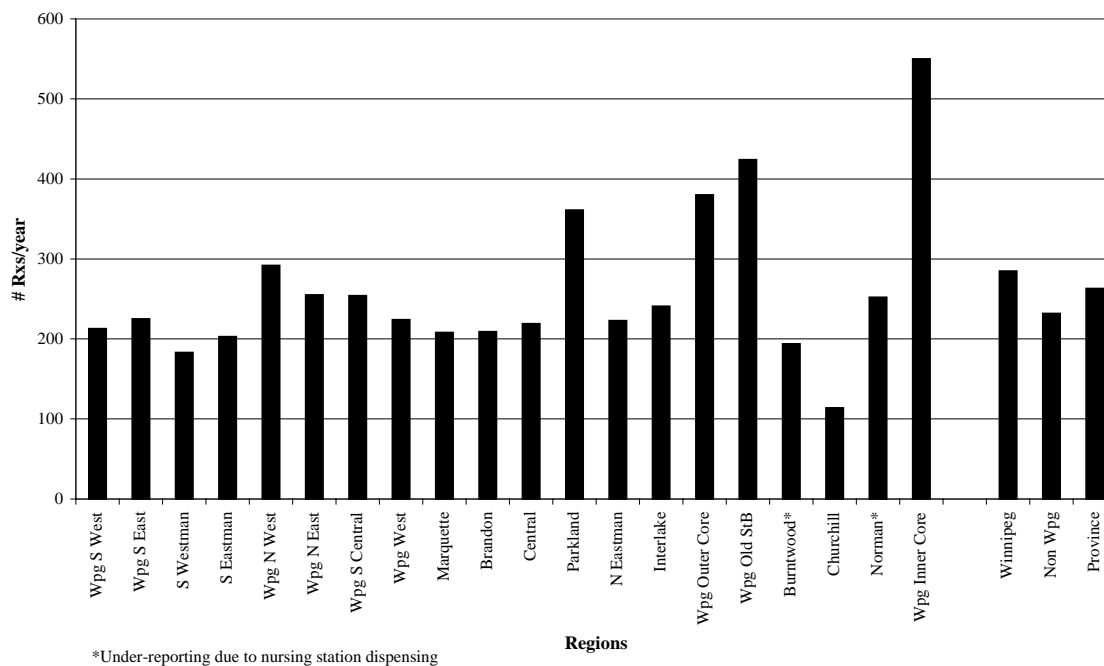
**Figure 83: Access (to at least one prescription) Per Year
Anxiolytics by Income Quintile**



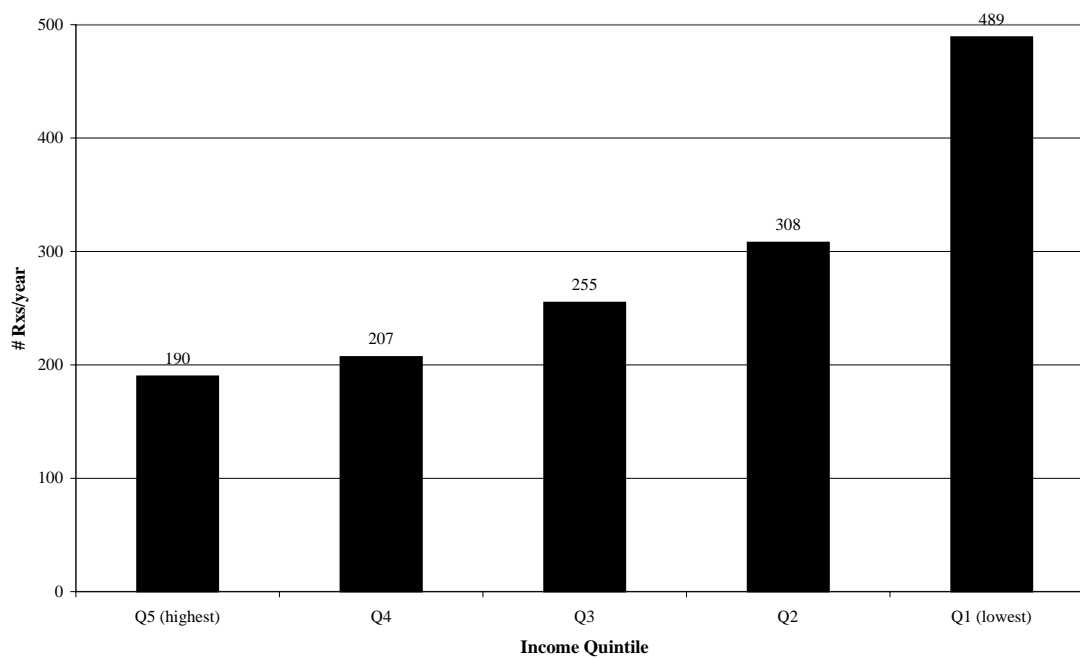
**Figure 84: Intensity of Use (# prescriptions/1000 residents) Per Year
Anxiolytics by Age/Sex**



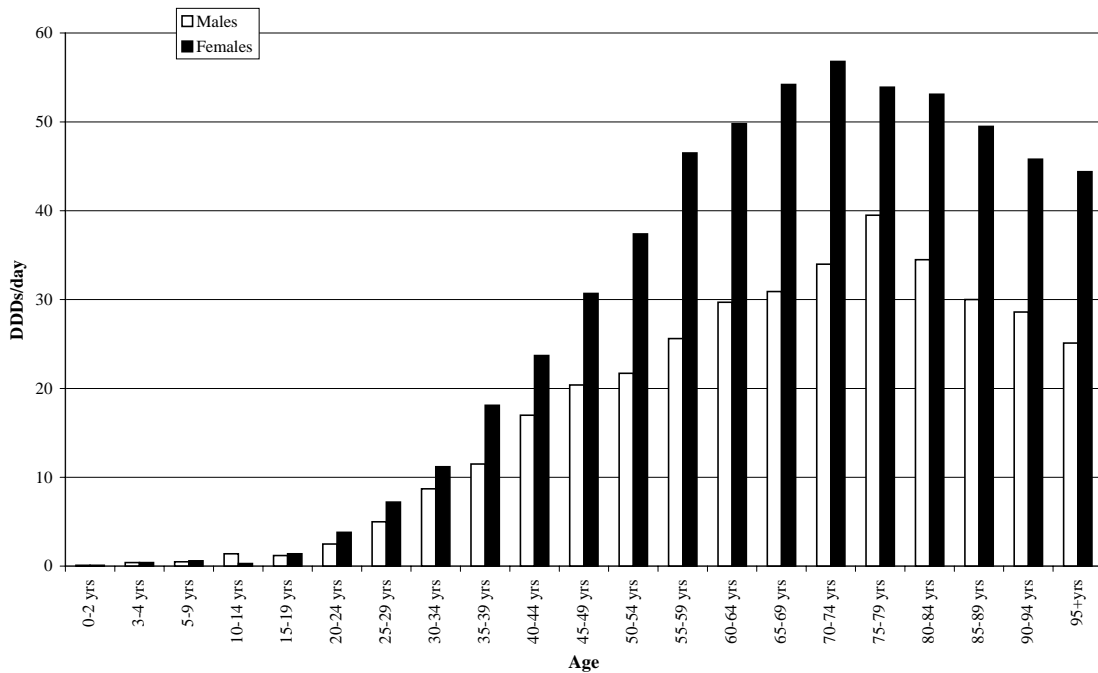
**Figure 85: Intensity of Use (# prescriptions/1000 residents) Per Year
Anxiolytics by Region**



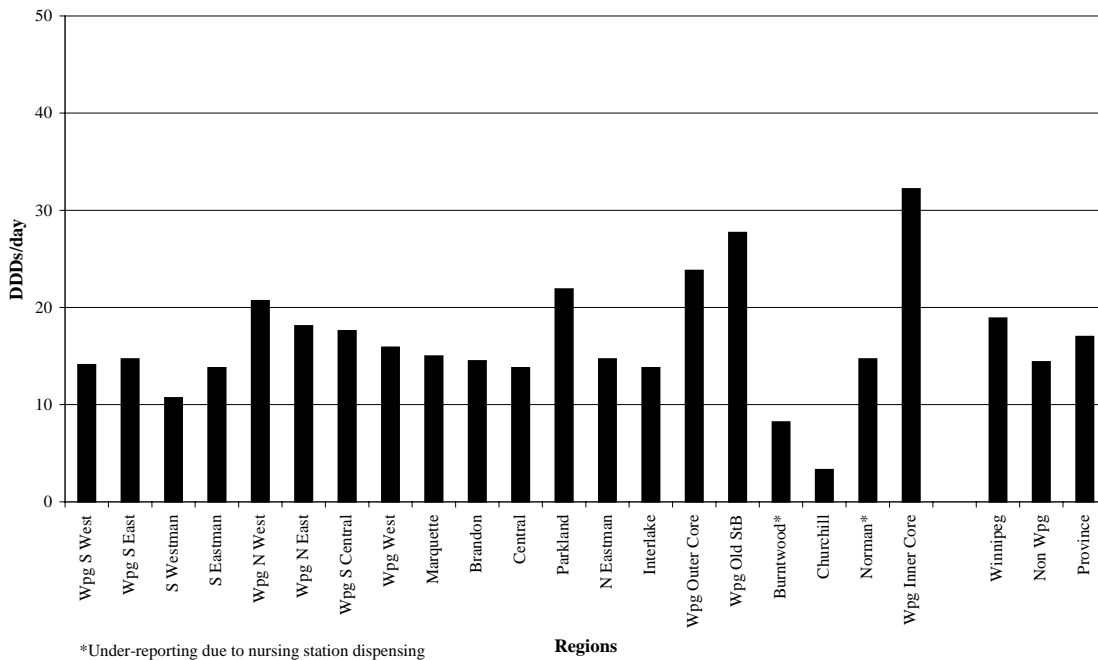
**Figure 86: Intensity of Use (# prescriptions/1000 residents) Per Year
Anxiolytics by Income Quintile**



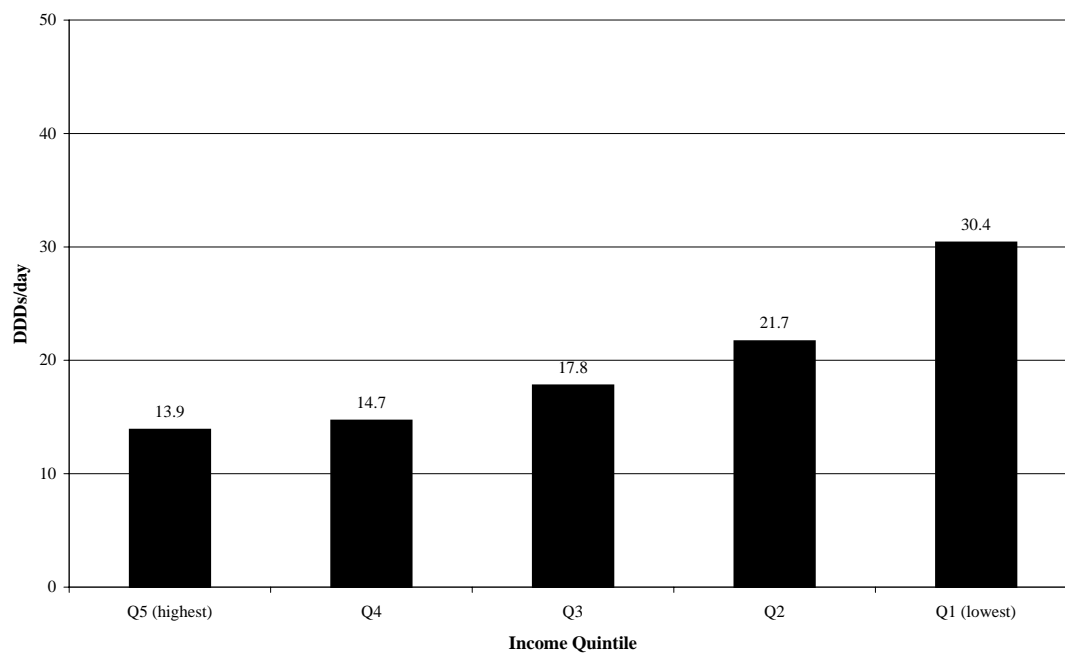
**Figure 87: Intensity of Use (#DDDs/1000 residents) Per Day
Anxiolytics by Age/Sex**



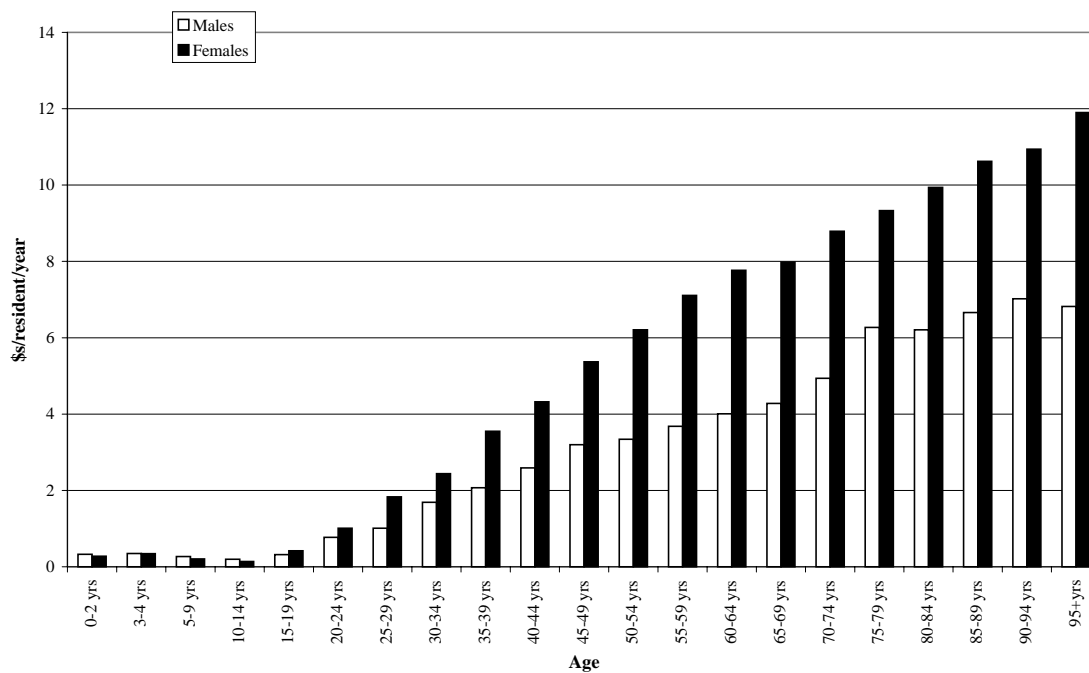
**Figure 88: Intensity of Use (#DDDs/1000 residents) Per Day
Anxiolytics by Region**



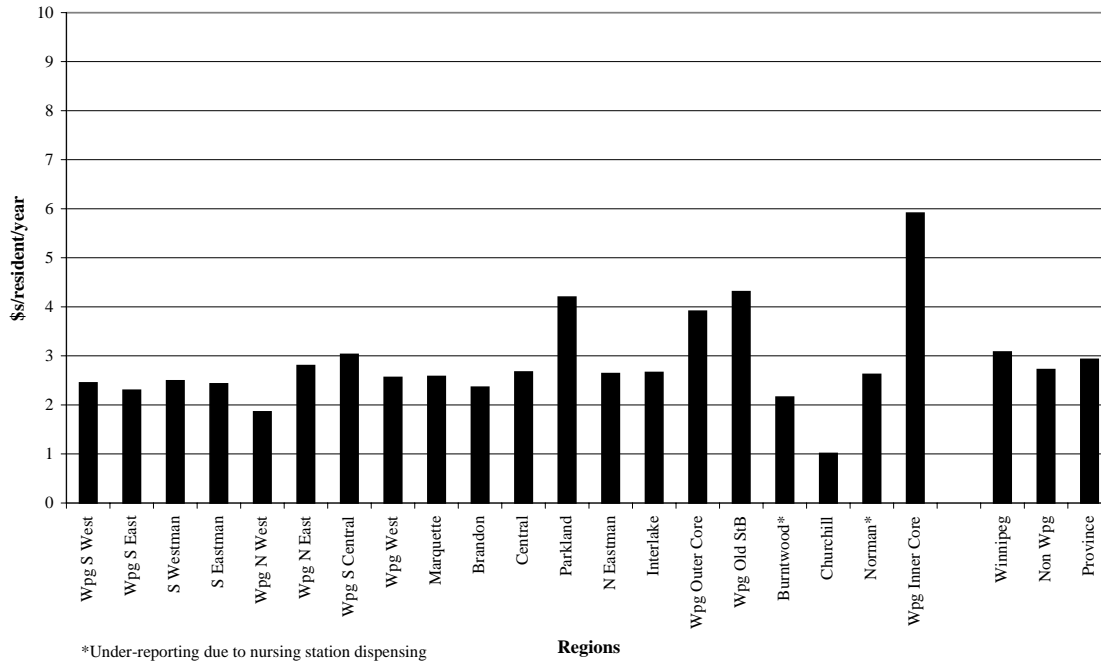
**Figure 89: Intensity of Use (#DDDs/1000 residents) Per Day
Anxiolytics by Income Quintile**



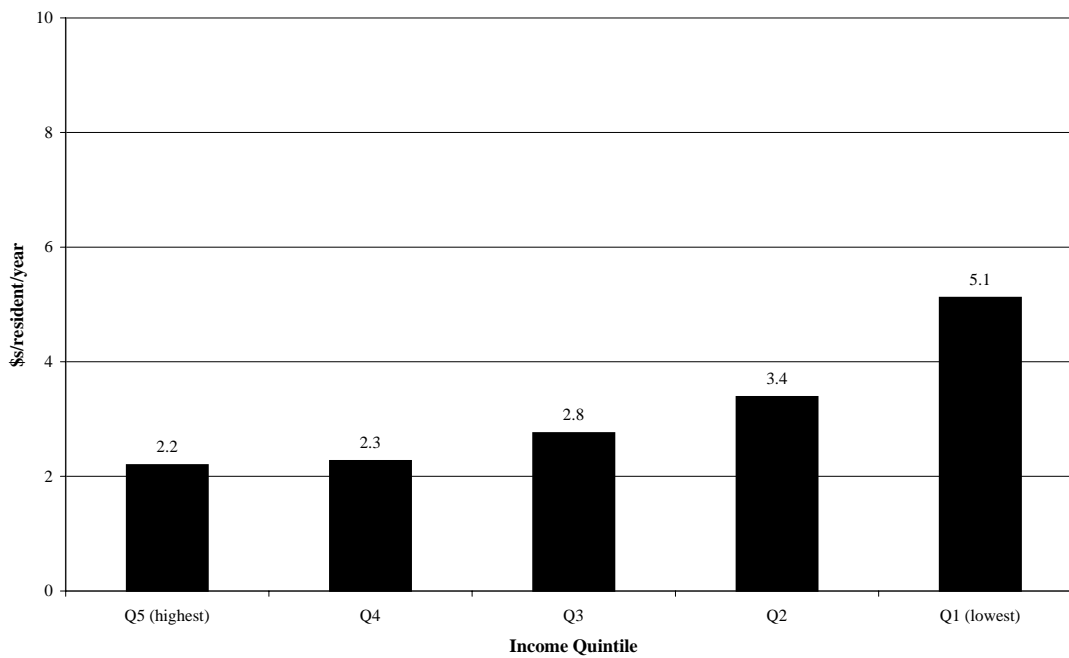
**Figure 90: Expenditures (\$/resident) Per Year
Anxiolytics by Age/Sex**



**Figure 91: Expenditures (\$/resident) Per Year
Anxiolytics by Region**

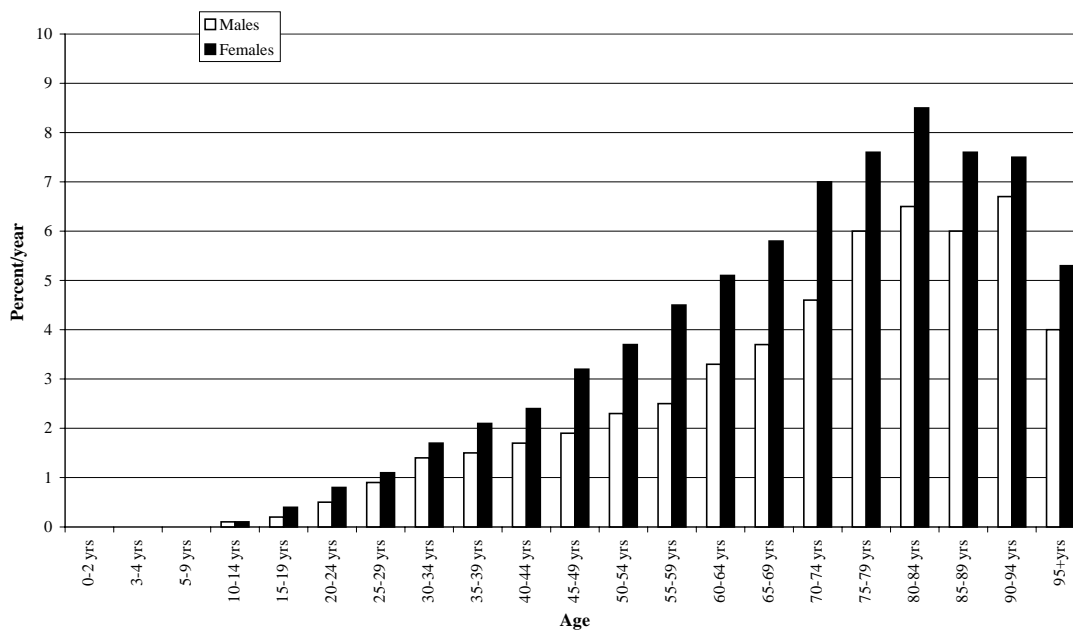


**Figure 92: Expenditures (\$/resident) Per Year
Anxiolytics by Income Quintile**

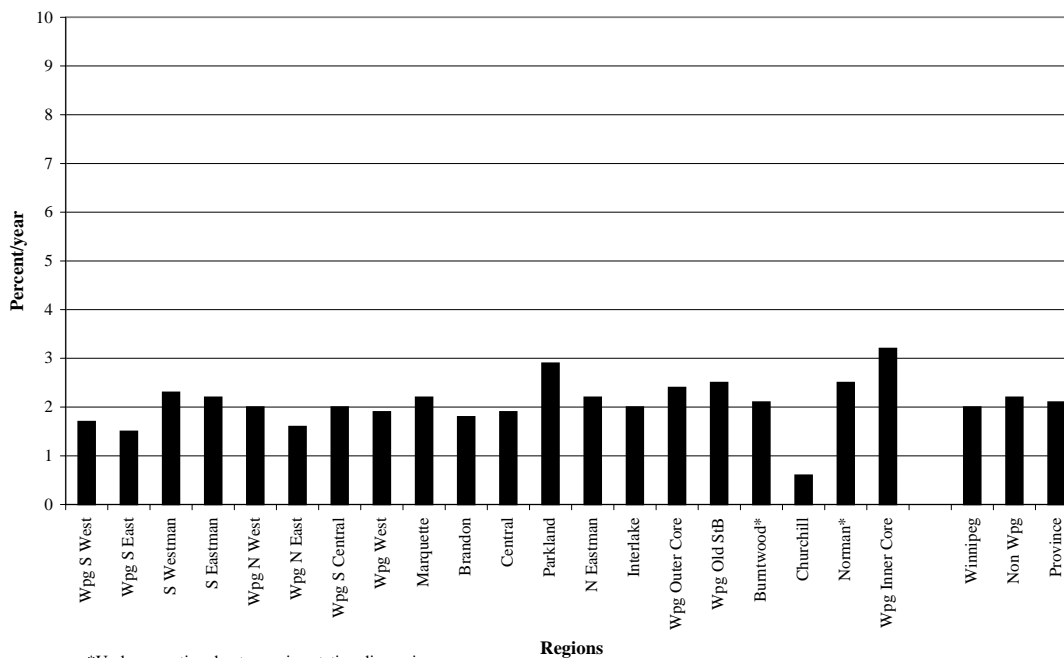


NERVOUS SYSTEM: HYPNOTICS/SEDATIVES

**Figure 93: Access (to at least one prescription) Per Year
Hypnotics/Sedatives by Age/Sex**

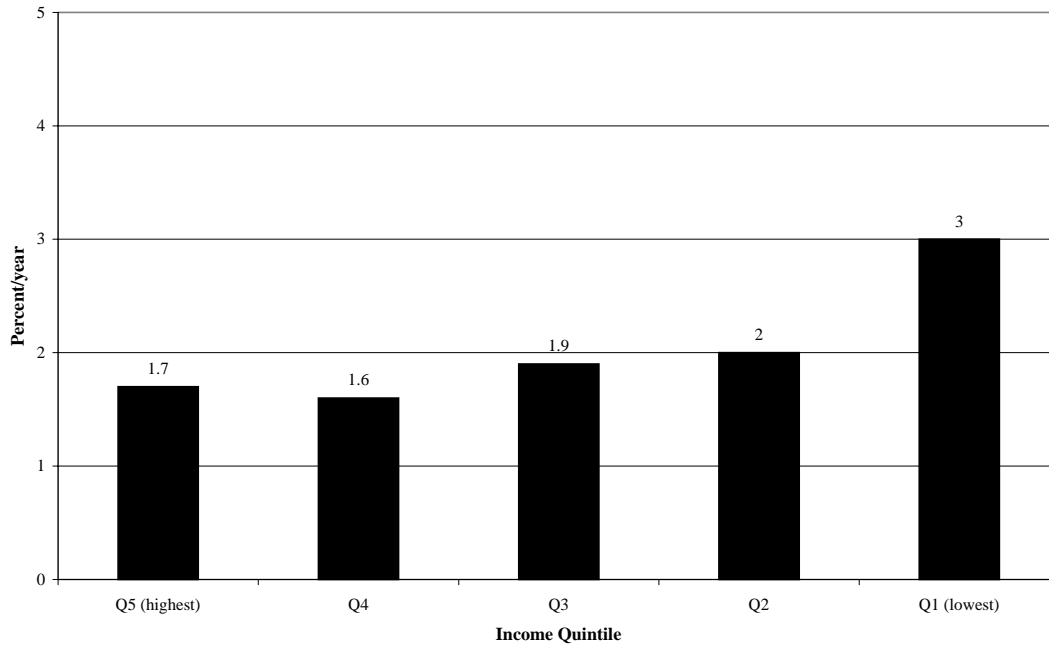


**Figure 94: Access (to at least one prescription) Per Year
Hypnotics/Sedatives by Region**

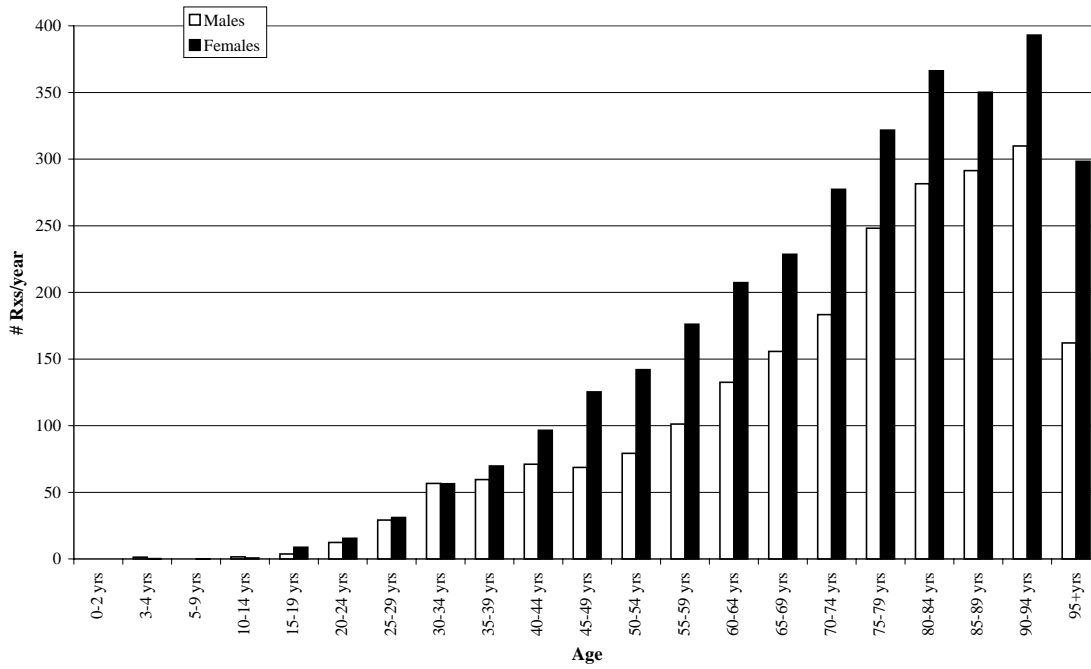


*Under-reporting due to nursing station dispensing

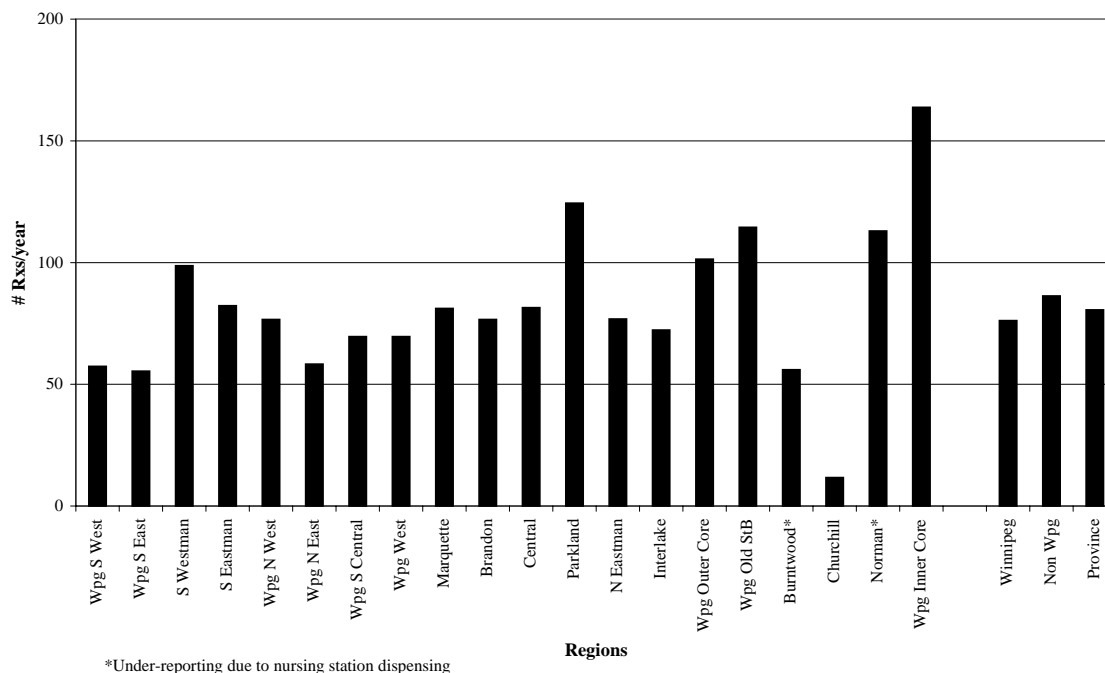
**Figure 95: Access (to at least one prescription) Per Year
Hypnotics/Sedatives by Income Quintile**



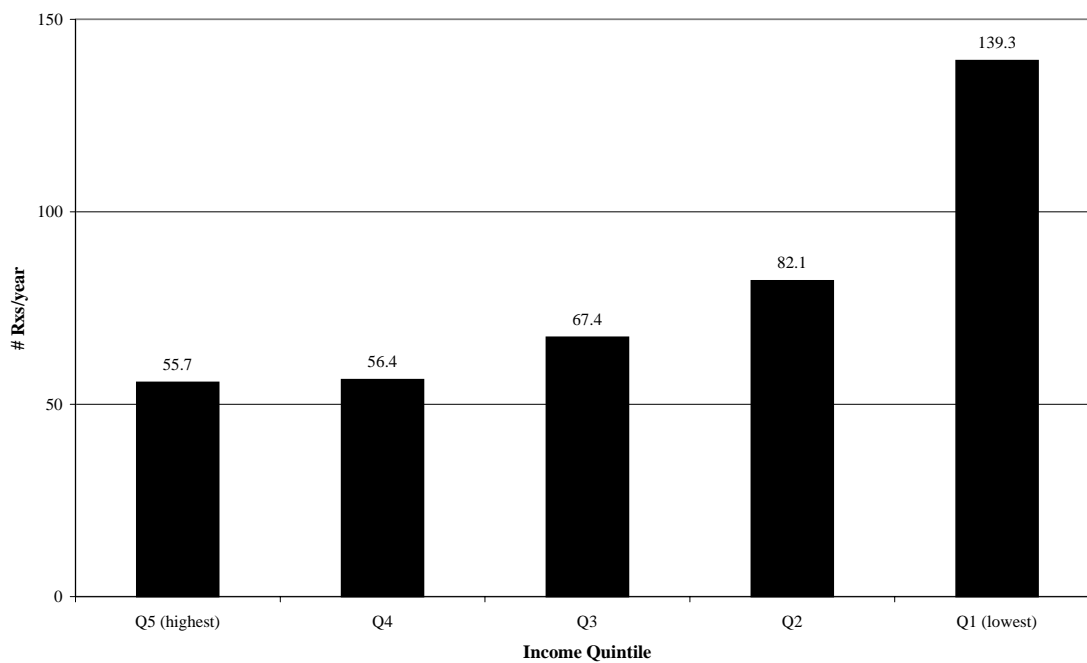
**Figure 96: Intensity of Use (# prescriptions/1000 residents) Per Year
Hypnotics/Sedatives by Age/Sex**



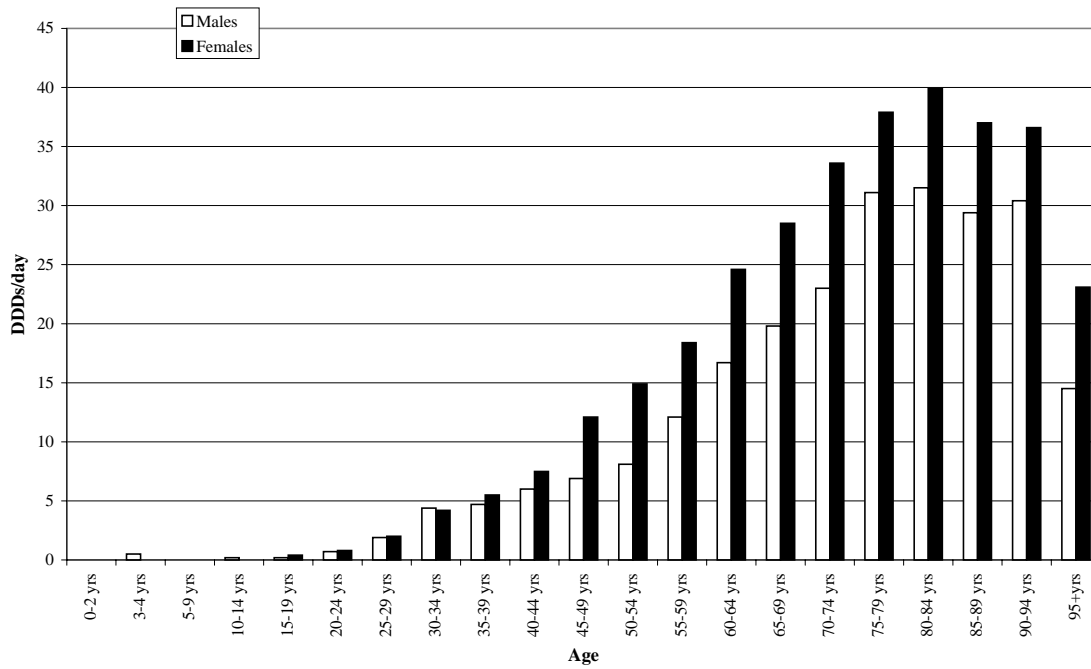
**Figure 97: Intensity of Use (# prescriptions/1000 residents) Per Year
Hypnotics/Sedatives by Region**



**Figure 98: Intensity of Use (#prescriptions/1000 residents) Per Year
Hypnotics/Sedatives by Income Quintile**



**Figure 99: Intensity of Use (#DDD/1000 residents) Per Day
Hypnotics/Sedatives by Age/Sex**



**Figure 100: Intensity of Use (#DDD/1000 residents) Per Day
Hypnotics/Sedatives by Region**

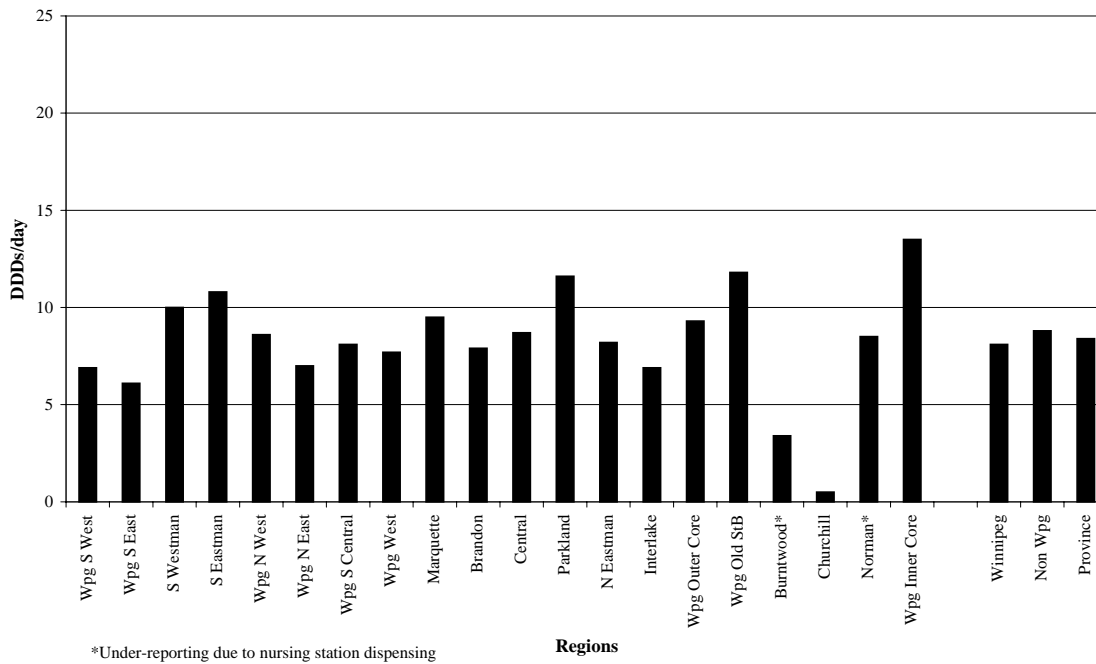


Figure 101: Intensity of Use (#DDD/1000 residents) Per Day Hypnotics/Sedatives by Income Quintile

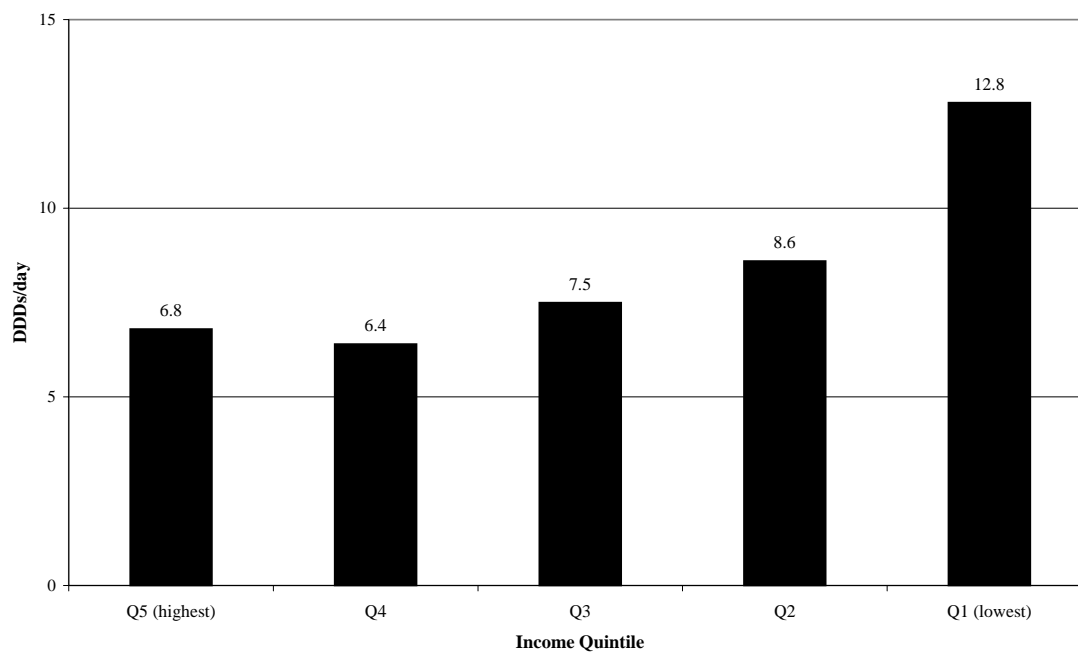
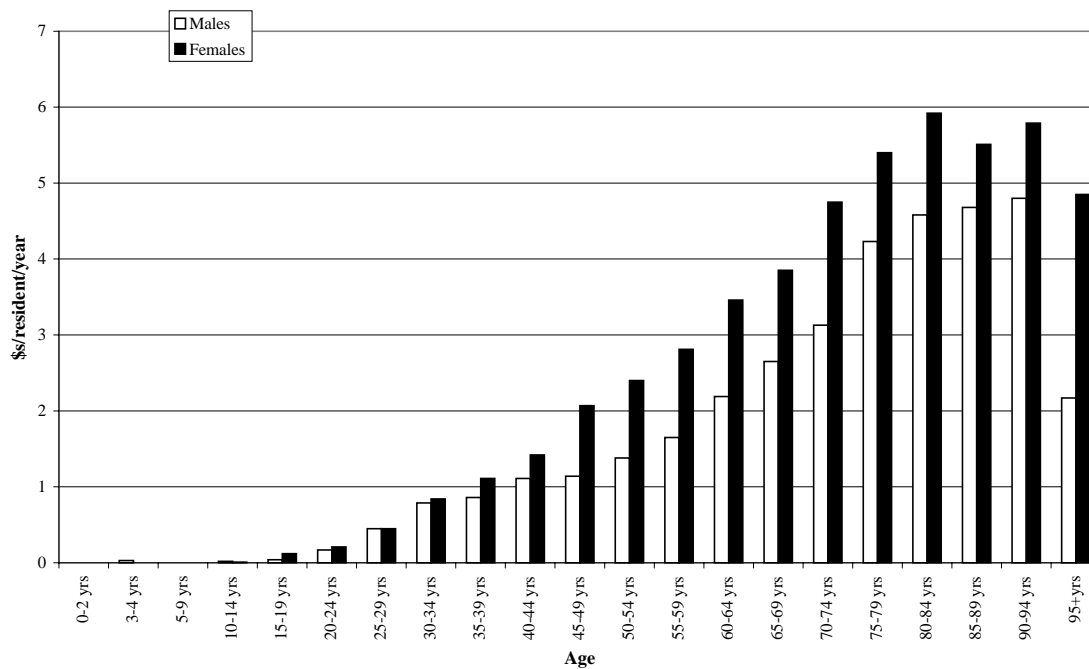
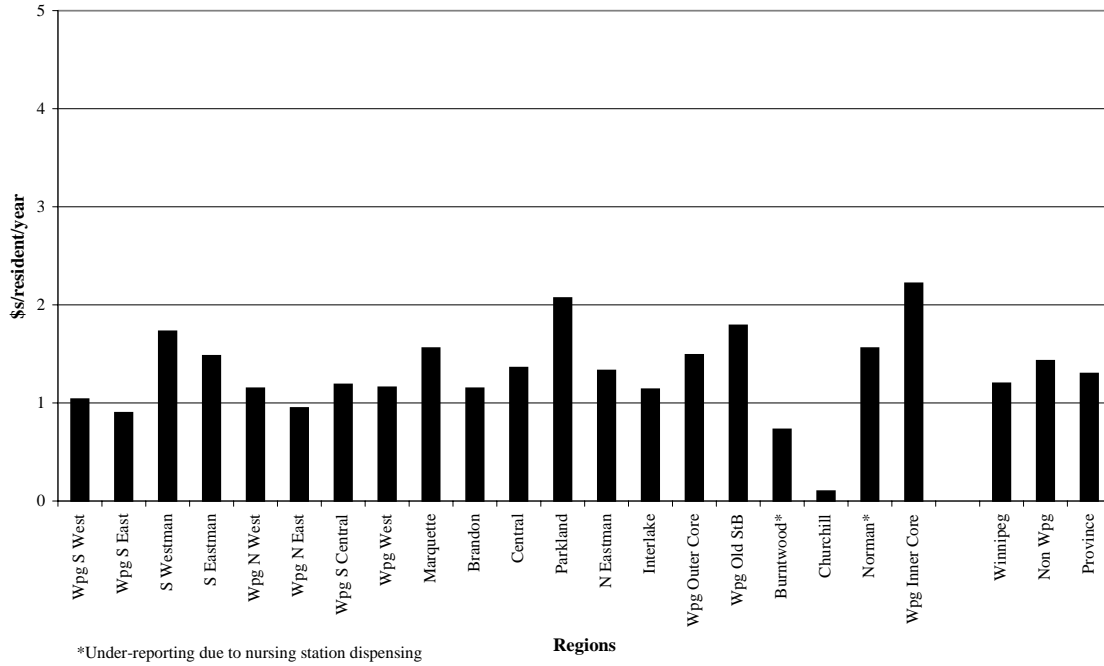


Figure 102: Expenditures (\$/resident) Per Year Hypnotics/Sedatives by Age/Sex



**Figure 103: Expenditures (\$/resident) Per Year
Hypnotics/Sedatives by Region**



**Figure 104: Expenditures (\$/resident) Per Year
Hypnotics/Sedatives by Income Quintile**

