

## Medication non-adherence in the homeless population in an Intermountain West city

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### Abstract

**Background:** Homelessness happens when people or household are unable to acquire and/or maintain housing they can afford. Approximately 17% of homeless individuals are also chronically ill. Studies have often not objectively measured medication non-adherence among the homeless population, probably due to lack of consistent pharmacy records. This study proposed to objectively estimate medication non-adherence to chronic medications among the homeless population in Salt Lake City, Utah.

**Methods:** A retrospective study design was used based on the pharmacy records from the Fourth Street Pharmacy based on four classes of chronic medications – asthma, diabetes, statins, and psychiatric medications. Data was collected between November 1, 2010 and February 28, 2011 on the variables: date of original prescription, number of refills on the original prescription, date of 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> fills, age, gender, and race. Primary non-adherence and medication refill non-adherence based on Continuous Measure of Medication Gaps were calculated.

**Results:** The medication refill non-adherence rate was 38.8% with asthma medications, 38.5% with diabetic medications, 27.2% with statins, and 47.1% with psychiatric medications. The primary non-adherence rate varied from zero percent to 20%.

**Conclusion:** The study concluded that this population has comparable non-adherence rates with asthma, diabetes, cholesterol lowering, and certain psychiatric medications than the general population.

### Introduction

Homelessness is a situation when people or household are unable to acquire and/or maintain housing they can afford (1). According to the National Alliance to End Homelessness, there are around 643,067 people experiencing homelessness on any given night in the United States (1). The 2008 US Conference of Mayors Study reported that the three primary causes of homelessness among families are lack of affordable housing, poverty, and unemployment; the major causes of homelessness among individuals are substance abuse, lack of affordable housing, and mental illness (2). Approximately seventeen percent of these homeless individuals are also chronically ill (1). Having a chronic disease requires medication adherence for the treatment to be successful. Medication non-adherence, defined as the extent to which a person's behavior does not coincide with medical or health advice, is very common with chronic medications (3, 4). Medication non-adherence can lead to poor health outcomes, admission to emergency rooms and hospitals,

increased physician visits, and overall increase in health care costs (5-10).

Several studies have focused on the health of the homeless, their health care utilization and barriers to their use of health care (11-15). Previous studies have reported several factors that affect medication adherence in homeless adults (16-18). Some of the major barriers to adherence among homeless are lack of privacy, lack of storage place for medications, and stolen/lost medications (16). Disaffiliation, the absence of the affiliative bonds that link individuals to a network of interconnected social structures, is another major reason for medication non-adherence among homeless (19). Whitney and Glazier reported the various factors that affect medication adherence at various stages of the medication taking process including assessing, retaining, and following the regimen (18). For accessing medications, financial difficulty and social isolation are the major barriers. Not having a permanent place to stay and stolen medications were the main reasons for not being able to retain the medications. For not following the regimen, the main barriers were alcohol and drug dependency, inability to follow instructions, mental illness, and lifestyle factors.

Past studies on medication non-adherence among the homeless often focused on populations taking HIV

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medications (20-22). The other chronic condition that was studied was psychiatric conditions. However, for psychiatric medications, the studies were focused on the reasons for non-adherence and interventions to improve the adherence (20-24). No studies were found that objectively estimated non-adherence with other common chronic medications such as asthma, cholesterol, and diabetes among the homeless population. A major barrier in measuring medication adherence among homeless population can be the lack of patient records for the homeless. The purpose of this exploratory study was to objectively estimate the primary non-adherence and medication refill non-adherence to chronic medications among the homeless population in Salt Lake City (SLC), Utah based on pharmacy records from the Fourth Street Pharmacy. Utah has a homeless population of 16,522 and has showed a 14% growth in homelessness from 2005 to 2011 (25). The Fourth Street Pharmacy associated with the Fourth Street Clinic dispenses around 44,600 free prescriptions annually.

### Methods

A retrospective study design was used based on the pharmacy records from the Fourth Street Pharmacy. The study only focused on a few widely-dispensed drugs from four classes of chronic medications: 1) asthma medications (Fluticasone/Salmeterol, Tiotropium, Budesonide/Formoterol, Albuterol/Ipratropium, and Beclomethasone); 2) diabetes medications (Insulin Glargine, Metformin, Glipizide Extended Release, and Insulin Lispro); 3) cholesterol lowering statins (Simvastatin and Atorvastatin); and 4) psychiatric medications (Buspirone, Risperisone, Olanzapine, Quetiapine, Escitalopram, Venlafaxine Extended Release, and Mirtazapine). The pharmacy obtains its medications through limited sources such as pharmaceutical company-sponsored patient assistance programs, Health Resources and Services Administration's 340(b) program, and occasionally through wholesaler at market prices. Because of the way it procures its medications, not all medications are available in the pharmacy to be dispensed and the physicians in the clinic prescribe based on the available medications in the pharmacy. Thus, the above mentioned medications were chosen based on the pharmacy manager's recommendations as few of the most widely dispensed medications from this pharmacy to the homeless population. Being an exploratory study, the goal was to estimate the rate of adherence with these commonly prescribed medications among the homeless.

All the pharmacy records for the abovementioned medications between November 1, 2010 and February 28, 2011 were reviewed. The four-month period was chosen

since the homeless population move quite frequently. These months were selected based on the fact that before the winter sets into SLC by November, the homeless people who want to avoid the cold weather might have already moved out. If they are still in SLC in November, they may be planning to stay here for the remainder of the winter season. Table 1 demonstrates the data collection table used for the study from the patient's pharmacy records. The Institutional Review Board Approval was received from the investigator's university.

Primary non-adherence happens when patient fails to fill a new prescription. For this study, primary non-adherence was calculated as picking up the medicine more than 30 days after the original prescription was written. The prescriptions that were not refillable were excluded from the further analyses of medication refill non-adherence. Medication refill non-adherence was calculated using the Continuous Measure of Medication Gaps (CMG). CMG is the total number of days for which a medication is unavailable within a specific period. CMG is calculated by dividing the days of treatment gaps by number of days of study participation (26). The days of treatment gaps is obtained by subtracting the days supplied from the days in the study period. The study period was calculated for each patient depending on the number of refills and the number of days supplied. For example, a patient with 2 refills and 30 days' supply of medicine each time will have a study period of 90 days (original fill of 30 days plus 2 refills). When compared with medication possession ratio (MPR) and proportion of days covered (PDC), CMG is a better measure of medication refill non-adherence since it takes into account the early oversupply that will fill a later gap between refills (27). In addition, it does not allow an early gap between refills to be accounted for by later stockpiling. A CMG value of zero reflects complete adherence and one reflects complete non-adherence. For this study, a patient with a CMG value less than 20% was defined as adherent based on earlier studies (27, 28).

### Results

Table 2 demonstrates the non-adherence and the confidence interval of the estimated non-adherence among the various medications in the four drug classes in detail.

*Asthma medications:* There were 155 records; the average age of the patient was  $49.55 \pm 8.74$  years; 72% were males; and 85% were white. The primary non-adherence rate was 4.5% and based on the 20% cut-off value of CMG, the medication refill non-adherence rate with asthma medications was 38.8%.

*Diabetes medications:* There were 287 records for diabetes medications. The average age was  $48.91 \pm 9.93$  years; 71% were males; and 80% were white. The primary non-adherence rate with diabetes medications was 12.9%, and the medication refill non-adherence rate was 38.5%.

*Statins:* There were 125 records; the average age was  $51.58 \pm 7.90$ ; 78% were males; and 84% were white. While the primary non-adherence rate was 6.4%, the refill non-adherence rate was 27.2%.

*Psychiatric medications:* There were 143 records. The average age was  $43.38 \pm 9.40$ , 58% were males, and 75% were white. The primary non-adherence rate was 2% and the refill non-adherence rate was 47.1%.

### Discussion

This study was able to objectively estimate the extent of medication non-adherence in the homeless population in SLC with certain classes of medications in chronic conditions such as asthma, diabetes, cholesterol, and psychiatric problems. The results from this study demonstrated that primary non-adherence was low among the homeless population in SLC. With medication refill non-adherence, the non-adherence was highest with psychiatric medication and least with statins.

Previous studies in asthma medications in general population demonstrated that the primary non-adherence rate with asthma medications range from 6 to 44% and the secondary non-adherence rates were more than 60% (4, 29). A study that measured the non-adherence rate in difficult to control asthma in general population found it to be 45% (30). A recent study, again in general population, showed that the adherence with beclomethasone was 50% by one year after treatment initiation (31). In the current study among homeless, the medication refill non-adherence was 50% with beclomethasone and albuterol/ipratropium, and ranged from 28% to 43% for the other asthma medications. As can be seen, the medication non-adherence of the homeless with asthma medications were less than or similar to that of the general population. A possible reason for the lower/similar non-adherence rate with asthma medications in this population can be the symptomatic nature of the asthma disease condition and the increased severity of the condition during the winter months possibly due to the exposure to asthma triggering factors such as smog and viral exacerbations(32, 33). The data for this study was collected during the winter months. Since the data was only collected from the pharmacy records, the health status or illness severity of this specific population is not known. However,

the public health records from Utah show that there were approximately 1600 hospitalizations due to asthma in 2011 in Salt Lake Valley (34). The age adjusted hospitalization rate for asthma in Salt Lake is approximately 5.5 per 10,000 and is higher than the state rate (34). Thus there is a possibility that these patients are sicker and hence demonstrating better adherence.

The medication refill non-adherence with oral diabetes medications in this study was 27% for metformin and 39% for glipizide extended-release. This is similar to the studies done in general population where the non-adherence rate with oral hypoglycemic agents in insured population was between 20 and 30% (35). The medication refill non-adherence to insulin therapy among low-income patients in general population was 41% (36). Compared to that, the non-adherence rate with Insulin Glargine was 43% and with Insulin Lispro was 67% among the homeless population in this study. Insulin injections need to be refrigerated and this might be the reason for the higher non-adherence rates with insulin injections compared to oral diabetes medications. In addition, the multiple dosing regimen of Insulin Lispro compared to the single dosing regimen of Insulin Glargine can possibly explain the comparatively higher non-adherence rate with Insulin Lispro (37, 38). A study conducted in Canada about diabetes management among homeless people reported inability to obtain insulin and other diabetic supplies when needed and the inability to coordinate medication with meals as the leading causes for medication non-adherence(39).

Non-adherence to statins among the homeless population in this study was 21 and 29% for simvastatin and atorvastatin respectively. This is similar to the earlier studies in general population, where non-adherence to statins (taking less than 80% of the prescribed medication assessed at 180 days) based on a literature review was 26% (40). Non-adherence with statins among non-Medicaid managed care organization enrollees was approximately 21% (41).

A study carried out in general population in Canada has determined that the non-adherence rate was 34.6% for antipsychotics, 34.7% for sedative-hypnotics, 38.1% for anxiolytics, 44.9% for mood stabilizers and 45.9% for antidepressants (42). In the current study, buspirone which is prescribed as an anxiolytic has a similar non-adherence rate at 40%. The non-adherence rate with venlafaxine (used as an antidepressant in this population) was 30% and that with mirtazapine (used as a sleep-aid in this population) was 23%. It can be noted that these rates are lower than that of the non-adherence rates with these medications in general

population. However, the non-adherence rates were higher with drugs used in schizophrenia such as risperidone, olanzapine, and quetiapine at around 70%. Medication adherence is a challenge for patients with schizophrenia and a literature review on medication adherence with schizophrenic patients showed it at 50% (43). The higher rate of non-adherence with schizophrenic medications among the homeless patients in this study can be attributed to the unavailability of the drug in two different ways for this population at this pharmacy. Compared to the other psychiatric drugs, schizophrenic drugs were usually provided only for a week or two weeks due to the need to adjust the drug dosage based on each patient's response to the drug. This can lead to non-adherence as the patient needs to come back to the pharmacy more often in the winter weather. In addition, if the patients start feeling better after taking the drug for few days they may have the tendency to discontinue the drug. In addition, these drugs were only available as brand drugs in the pharmacy; thus sometimes limiting the availability of the drug on a long term basis.

As can be seen from the published literature, when compared to the rates in general population, the medication refill non-adherence rate was lower in asthma medications and similar in cholesterol medications. There can be several reasons for the low or comparable adherence rates with this population. The first and major reason can be the zero cost for medications for the homeless patient. As noted from the literature, cost of medications and unavailability of medications are few of the important barriers for medication adherence among the homeless (13, 23, 39, 46). All the medicines are provided free of cost from the Fourth Street Pharmacy. In addition, the physical location of the clinic and the pharmacy in the center of the town makes it easier for the homeless to access them without difficulty. This may at least explain the low rates of primary non-adherence. Also, the low primary non-adherence can be another reason for improved refill adherence (22). Second, the pharmacy, with the help of the pharmacy manager and a staff pharmacist, teaches the patients to become accountable for their diseases and medications. Previous studies on medication adherence in homeless reported that communication issue was a major barrier for adherence in this population and thus educating homeless patients about the need for medication adherence and follow-up visits is considered as an important step in their treatment plan (16, 23, 45, 46). For asthma and diabetes medications, the Fourth Street Pharmacy patients are taught how to use the inhaler and the glucometer with special focus on the need of medication adherence. For diabetes patients, the pharmacist who is also a trained diabetes specialist provides intensive education sessions for

the patient, which continues over time with ongoing follow-up between the patient and the pharmacy staff. As appropriate, the pharmacist again meets one-on-one with the patient to review therapeutic goals and outcomes. For psychiatric conditions, patients are provided regular counseling by a prescribing psychiatric nurse, again with emphasis on medication adherence. Third, there is a human element that might be improving the medication adherence in this population. The staff at the Fourth Street Clinic and Pharmacy provides a sense of warmth and belonging to these patients while they are at the clinic or pharmacy; the patient population itself fosters an independent culture where patients feel comfortable. This may prompt the homeless to visit the pharmacy on a regular basis and fill their medications. Social support is a major factor in improving medication adherence (47-50). For this specific homeless population, it is not possible to determine whether they are transiently or permanently homeless. Thus, the assumption that the social support from the pharmacy staff might be one of the reasons for improved medication adherence.

The significantly higher medication refill non-adherence rate for this population compared to the primary non-adherence can be due to any reasons for non-adherence such as illness and/or medication beliefs of the patient, slow response to the symptoms, or discontinuing medications when feeling better or worse. It may also be that these patients might have moved away or are not homeless anymore. However, future studies should be carried out to understand the reasons for higher refill non-adherence so that effective intervention strategies can be developed. Also, the comparatively higher non-adherence rate with psychiatric medications can be a cause of concern as this may lead to suboptimal clinical outcomes for patients with mental illnesses. Mental illness is one of the predictors for homelessness and patients with schizophrenia and bipolar disorders have higher odds of being homeless compared to other psychiatric conditions (51). Thus, the higher non-adherence with psychiatric medications, especially with medications for schizophrenia as seen from this study can create a cycle that will be difficult to break, thereby increasing the health care costs of the society.

Measuring the medication adherence among the homeless is important as this can be a major key in reducing the overall health care costs by avoiding emergency room and hospital admissions that can result from uncontrolled chronic conditions. A Canadian study reported that 47% of the 156 homeless men studied had been to the emergency room in the previous year and 24% got admitted to the hospital overnight or longer (44). This exploratory study is a step towards understanding the medication adherence of the

homeless with chronic medications. Further studies need to be conducted to understand the reasons for not adhering with medications especially with certain psychiatric medication to develop appropriate intervention strategies for the homeless. Qualitative analyses such as in-depth interviews with these individuals, observing the communication between these individuals and the health care providers, can provide significant input into the barriers for refill adherence among this population. In addition, linking the adherence measures with the clinical outcomes can be another way of validating these results.

#### *Limitations of the study:*

The study is not without limitations. First, the study is a retrospective data analysis based on refill records from the pharmacy. As with any other adherence retrospective study, though patients filled the prescription, the actual consumption of the medicines is not known. Perhaps another study linking the pharmacy records with the medical charts may give more insight into the actual clinical outcome of the homeless patients. It is also to be kept in mind that these are homeless patients and those who did not obtain the refills might have moved away or who became eligible to fill prescriptions through Medicaid. Second, the analysis is limited to four months from November 2010 to February 2011. Thus, generalizing the results from this study has to be done cautiously. The patients approaching the pharmacy during these winter months as well as the health conditions of these individuals may be different from the homeless individuals during the other months. The winters in SLC has average temperatures ranging from 20 to 45 degrees Fahrenheit. Thus, the homeless staying in SLC for the winter may be healthier than those who move out of city during the winter months. Third, the Fourth Street Pharmacy cannot be considered as a representative pharmacy for the homeless, thus further limiting the generalizability of the study. However, there are no other pharmacies in SLC that exclusively provides to the uninsured homeless population. Fourth, there is a possibility of underestimation of adherence since the analysis of CMG also included patient records that never made any refills. Studies have shown that excluding those records that exhibit early non-persistence (no refills) can overestimate adherence by 9 to 18% (52). Thus, it was decided to include those records for a more conservative approach in analyzing the data. Finally, it is also to be kept in mind that being an exploratory study, the data available was limited and hence only limited analysis were carried out.

Unlike a conventional pharmacy, the Fourth Street Pharmacy only caters to uninsured homeless population and has

different operation system. Also, the study did not collect any data on the actual clinical outcomes. Thus, it is not possible to determine whether the adherence rates actually converted to clinical outcomes.

#### **Conclusions**

The aim of this exploratory study was to estimate the extent of medication non-adherence among the homeless population in Salt Lake City for certain medications in four chronic illnesses including asthma, diabetes, cholesterol, and psychiatric problems. The study concluded that this population has comparable rates of non-adherence with certain medications in the classes of asthma, diabetes, cholesterol, and psychiatric conditions compared to the general population. Further studies are needed to understand the actual behavior of medicine consumption and the specific reasons for non-adherence in this particular population.

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**Table 1: Data Collected for the Calculation of Medication Refill Adherence**

<b>Data collected:</b>	<b>Drugs studied:</b>
Drug Class	Fluticasone/Salmeterol
Subject ID	Tiotropium
Age	Budesonide/Formoterol
Sex	Albuterol/Ipratropium
Race	Beclamethasone
Date of original prescription	Insulin Glargine
Number of refills on the original prescription	Metformin
Date of first/original fill of the prescription	Glipizide Extended Release
Number filled	Insulin Lispro
Number of days supplied based on the dosage	Simvastatin
Date of first refill	Atorvastatin
Date of second refill	Buspirone
Date of third refill	Risperidone
Date of fourth refill	Olanzapine
Date of fifth refill	Quetiapine
	Escitalopram
	Venlafaxine Extended Release
	Mirtazapine



**Table 2:** Non-adherence for each selected medication in the four chronic medication drug classes among the homeless population in Salt Lake City, Utah

Drug class (Number of patient records)	Primary non-adherence – N (%)	95% confidence interval of the estimated primary non-adherence proportion	Number with no refill	Number included in the analysis of CMG	Medication refill non-adherence – N (%)	95% confidence interval of the estimated refill non-adherence proportion
<b>Asthma</b>						
Fluticasone/Salmeterol (39)	2 (5%)	(-1.84, 11.84)%	5	34	12 (35.3%)	(20.3, 50.3)%
Tiotropium (48)	1 (2%)	(-1.96, 5.96)%	5	43	12 (27.9%)	(15.21, 40.59)%
Budesonide/Formoterol (11)	2 (18%)	(-4.7, 40.7)%	4	7	3 (42.9%)	(13.65, 72.15)%
Albuterol/Ipratropium (6)	0 (0%)	(0, 0)%	0	6	3 (50%)	(9.99, 90.01)%
Beclamethasone (51)	2 (4%)	(-1.38, 9.38)%	12	39	20 (51.3%)	(37.58, 65.02)%
<b>N = 155</b>	<b>7 (4.5%)</b>	<b>(1.24, 7.76)%</b>	<b>26</b>	<b>129</b>	<b>50 (38.8%)</b>	<b>(31.13, 46.47)%</b>
<b>Diabetes</b>						
Insulin Glargine (60)	8 (13.3%)	(4.71, 21.89)%	6	54	23 (42.6%)	(30.09, 55.11)%
Metformin (137)	16 (11.6%)	(6.24, 16.96)%	13	124	33 (26.6%)	(19.2, 34)%
Glipizide Extended Release (44)	4 (9%)	(0.54, 17.46)%	3	41	16 (39%)	(24.59, 53.41)%
Insulin Lispro (46)	9 (19.6%)	(8.13, 31.07)%	3	43	29 (67.4%)	(53.85, 80.95)%
<b>N = 287</b>	<b>37 (12.9%)</b>	<b>(9.02, 16.78)%</b>	<b>25</b>	<b>262</b>	<b>101 (38.5%)</b>	<b>(32.87, 44.13)%</b>
<b>Cholesterol</b>						
Simvastatin (48)	5 (10.4%)	(1.76, 19.04)%	7	41	10 (20.8%)	(9.32, 32.28)%
Atorvastatin (77)	3 (3.8%)	(-0.47, 8.07)%	4	73	21 (28.8%)	(18.69, 38.91)%
<b>N = 125</b>	<b>8 (6.4%)</b>	<b>(2.11, 10.69)%</b>	<b>11</b>	<b>114</b>	<b>31 (27.2%)</b>	<b>(19.4, 35)%</b>

Psychiatric Conditions						
Buspirone (11)	1 (9%)	(-7.91, 25.91)%	1	10	4 (40%)	(11.05, 68.95)%
Risperidone (38)	0 (0%)	(0, 0)%	9	29	18 (62%)	(46.57, 77.43)%
Olanzapine (12)	0 (0%)	(0, 0)%	3	9	7 (77.8%)	(54.29, 101.31)%
Quetiapine (25)	0 (0%)	(0, 0)%	5	20	14 (70%)	(52.04, 87.96)%
Escitalopram (4)	0 (0%)	(0, 0)%	1	3	1 (33.3%)	(-12.89, 79.49)%
Venlafaxine Extended Release (18)	1 (5.5%)	(-5.03, 16.03)%	1	17	5 (29.4%)	(8.35, 50.45)%
Mirtazapine (35)	1(2.9%)	(-2.66, 8.46)%	4	31	7 (22.6%)	(8.74, 36.46)%
<b>N = 143</b>	<b>3 (2%)</b>	<b>(-0.29, 4.29)%</b>	<b>24</b>	<b>119</b>	<b>56 (47.1%)</b>	<b>(38.92, 55.28)%</b>