Identification of primary polydipsia in a severe and persistent mental illness outpatient population: A prospective observational study

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A R T I C L E   I N F O

Article history:
Received 12 May 2012
Received in revised form 4 April 2013
Accepted 6 April 2013

Keywords:
Polydipsia
Outpatients
Schizophrenia
Nicotine
Psychosis

A B S T R A C T

Studies to date have only investigated primary polydipsia in hospitalized psychiatric patient populations, where rates range from 3% to 25%. The objective of the present study was to determine the occurrence of primary polydipsia in a psychiatric outpatient population, and to determine the perceptions of outpatients with self-induced water intoxication regarding reasons for drinking excess fluids, health risks, and insight into their behavior. All 115 psychiatric outpatients from a Community Outreach Program in Kingston, Ontario, were invited to participate in this study. Of these, 89 (77.4%) were enrolled. Data collection included chart reviews, structured interviews, weight measurements, and urine collection. The incidence of primary polydipsia was found to be 15.7%. One-half of the polydipsic people presenting with medical complications suggestive for water intoxication had cigarette smoking as a strong correlate. There were interesting answers to the self-induced water intoxication questionnaire. These showed a lack of knowledge related to the normal quantity of fluids necessary daily and about healthy behaviors. Excessive drinking occurs in psychiatric patient populations outside of institutional/hospital settings. Patients have limited awareness of the severity and possible complications from their problem. Given the prevalence of polydipsia, more effort should be put into identifying and treating this problem.

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1. Introduction

Disorders of fluid and electrolyte balance of varying forms and severity are common among psychiatric patients (Hoskins and Sleeper, 1993). Such disorders were first reported over half a century ago (Sleeper and Jellinek, 1936). Since these early reports, disturbances of water homeostasis among psychiatric patients have been widely recognized, particularly the condition whereby patients consume excessive quantities of liquid, which is termed “polydipsia”.

Polydipsia has been categorized into “primary”—no obvious medical etiology, and “secondary”—caused by medication such as lithium, or comorbidity such as kidney failure (Zubenko, 1984). However there is still little consensus about this self-induced water intoxication’s etiology and treatment. The diagnosis is challenging, and the disorder may easily be overlooked (Koczapski et al., 1987). In such patients, hyponatremia and water intoxication are often episodic, and routine serum sodium concentrations are often normal (Koczapski and Millson, 1989).

When patients do become symptomatic, they may not present with the classic progression of symptoms of water intoxication, but may instead appear lucid 1 min and begin having seizures the next, resulting in the incorrect diagnosis of idiopathic epilepsy (Koczapski and Millson, 1989). Water intoxication is thought to be associated with a multiplicity of factors including length of time since onset of mental illness (Vieweg et al., 1985), length of time of excess fluid consumption (Hamazoe et al., 1986), nicotine consumption (Allon et al., 1990; Blum, 1984), gender and status of the underlying psychiatric disorder (Zubenko, 1984; Raskind, 1974).

Water intoxication, caused by polydipsia, has been linked to increased mortality and morbidity and is considered a potentially life-threatening but preventable disorder (Verghese et al., 1993). The literature on the prevalence and epidemiological characteristics of primary polydipsia in psychiatric patients has been based primarily on inpatient psychiatric populations. Estimates of its prevalence in institutionalized and chronic psychiatric populations have ranged from 3% to 25% (Illosky and Kirch, 1988). The
ambiguity regarding prevalence rates of primary polydipsia and related disorders is in part due to the absence of precise and validated diagnostic criteria (Goldman, 1991). The most obvious method for diagnosing primary polydipsia is direct measurement of daily fluid intake. Conventionally excessive fluid consumption is defined as three or more liters per day (Koczapski et al., 1987). The application of this direct measure, however, has been difficult within the psychiatric context. It requires considerable staff resources and a highly cooperative patient and, unfortunately, outpatient clinical settings are not usually equipped with sufficient staff or facilities to undertake this level of monitoring.

Relatively recent reports from community groups suggest that non-hospitalized patients also experience excessive drinking behaviors (Bralet et al., 2007; Williams and Kores, 2011).

Moreover, many individuals may not cooperate with intrusive monitoring and/or may be secretive regarding their drinking behavior. As a result there are no prevalence studies of primary polydipsia based on direct measurement of fluid intake in the psychiatric literature (Godleski et al., 1989). Instead, the study of primary polydipsia has proceeded either by screening patients identified on the basis of extreme forms of the disorder or by using derived measures such as measures of urine volume, specific gravity of urine (SPGU), urine creatinine and daily weight gain (Jayendra and Patel, 1994). Unfortunately, while the face validity of these measures is widely acknowledged (De Leon et al., 1994; Verghese et al., 1996), there have been few empirical attempts to determine if these measures yield comparable prevalence results or even measure the same underlying phenomenon.

The objective of the present study is to determine the occurrence of primary polydipsia in a community-dwelling psychiatric population.

We hypothesized that excessive drinking would be identified in schizophrenia patients residing in community settings at rates comparable to those previously identified with inpatient samples. We also hypothesized that patients with polydipsia would not correctly identify the severity and possible complications of their problem.

2. Methods

This was a prospective, observational, cohort study. The study involved outpatients in follow up with the Community Rehabilitation Team functioning under the umbrella of Providence Care-Mental Health Services, Kingston, Ontario, Canada. The team offers psychiatric supervision, case management, occupational therapy, dietician consult as well as some part time paid jobs for the clients (under supervision) in our cafeteria, card factory or car wash services. Around half of our out-patient population is living in homes for special care and half with their families or on their own (supervised by their case manager). The Homes for Special Care program was originally established in 1964 by the Ontario Ministry of Health to provide long term residential care to persons discharged from Provincial Psychiatric Hospitals who required supervision or assistance with activities of daily living.

2.1. Subjects

All 115 of the Community Outpatient Treatment (COT) Program’s clients, with no apparent exclusion criteria (see below), were approached by a member of the study team, given information about the study, and asked if they wished to participate. Where patients had a proxy for consent, this individual was approached. Written consent was obtained from patients (or proxies) who agreed to participate in the study. Inclusion criteria were: age 18 or older and able to give informed consent or have a designated proxy. Exclusion criteria included a diagnosis of kidney failure, and/or treatment with lithium.

2.2. Data collection:

A 15-item structured interview developed by Millson was administered to the study population in order to assess their understanding of and attitudes toward drinking fluids (Millson et al., 1992).

This instrument (see Appendix 1) was used to ask subjects standardized questions regarding their drinking pattern and behaviors.

Demographic (age, living arrangements, gender, smoking status, drug and alcohol use) and medical information (diagnoses, medications) were obtained from the chart or from the patient directly.

Each patient participated in this study for four days spaced over six weeks. All patients were asked to provide urine samples to test for urinary tract infection (performed once) and specific gravity (SPGU). Two urine samples were collected per day, in the morning and in the afternoon, once every two weeks for six weeks as well as weight measurements for normalized Diurnal Weight Gain (NDWG) (two times a day, morning and afternoon, once every two weeks for six weeks). We chose SPGU and NDWG as these are the least invasive tests. NDWG also picks up patients that likely have been drinking excess fluid for some time. These are patients who are more at risk of dying from excessive fluid intake.

Patients were included in the study if they had a SPGU lower than 1.009 and a NDWG more than 4% (Koczapski et al., 1987).

2.3. Data analysis

Data were analyzed with SPSS (version 18.0). Patients who were found to meet the clinical definition for polydipsia were compared to those without polydipsia with respect to other diagnoses, comorbidities, and clinical and demographic variables. Analysis to describe frequency and characteristics were univariate descriptive (means, medians, frequency and percentages). A bivariate comparison between groups was made using, where appropriate, t-tests, chi-squared analysis, correlations and/or nonparametric analysis such as Wilcoxon and Mann-Whitney U tests.

3. Results

Of the 115 psychiatric outpatients in the Community Outreach special care facilities in Kingston that made up the potential study population, 14 (12.2%) met one or more of the exclusion criteria and 12 (10.4%) refused, resulting in a final study sample of 89 (77.4% of eligible patients).

Fourteen (16.7%) of the 89 individuals in this study met the criteria for polydipsia, and 75 (90.3%) did not, thus the overall prevalence of polydipsia among our study population was 15.7%. 90.4% of the polydipsia patients had a primary diagnosis of schizophrenia compared to 73.8% of the non-polydipsic group; however this difference was not statistically significant ($\chi^2 = 2.37, P=0.124$). The mean age of participants was 56.1 (11.8) years for polydipsic patients compared to 57.1 (11.1) years in non-polydipsic patients.

The number of cigarettes smoked per day was statistically significantly higher in polydipsic patients vs. non-polydipsic patients ($\chi^2=28.97, P=0.035$). No other demographic variables were found to be statistically significantly different (See Table 1).

Patients identified with polydipsia (see Table 2) responded “yes” significantly more often than those without polydipsia on the following two questions: “Do you think you drink more than average?” ($\chi^2=12.99, P<0.0001$), and “Has anyone ever made a comment about your drinking?” ($\chi^2=4.50, P=0.034$).

Patients with polydipsia also had statistically significant changes in weight measurements in each of the three days this information was collected compared to those without polydipsia. The mean of the changes in Daily Weight p.m. vs. a.m. for the polydipsic patients were: first day 3.6 kg (2.64) comparable with 1.01 kg (2.16) for non-polydipsic patients $P<0.001$; the second day 4.03 kg (2.98) comparable with 1.28 kg (1.82) $P<0.001$; the third day 4.95 kg (2.99) comparable with 1.10 kg (1.63) $P<0.001$.

Patients with polydipsia had changes in urine specific gravity, meting inclusion criteria for this group (See Table 3). It was estimated that patients identified with polydipsia drank significantly more in a typical day than those without polydipsia (4.61 L/day vs. 2.76 L/day, $P=0.002$) and wanted to drink more in a typical day than those without polydipsia (4.28 L/day vs. 2.40 L/day, $P=0.003$), (See Table 4). There were no statistically significant differences between the two groups with respect to their fluid of...
preference (water, beer, wine, fruit juice, coffee, tea, spirits, or soft drinks), with both groups ranking water most frequently as their first choice of fluid, and coffee as their second.

The open-ended questions on the structured interview resulted in some interesting responses from our polydipsic patients, the motivations behind the habit being thirst in 20% of situations, delusion 40%, desire for intoxication in 20% and “I don’t know” 10%.

Some examples of patient’s answers to the open-ended questions on the structured interview are:

**Question 1.** Why do you drink the amount of fluid that you do? —“Thirsty”; “Keeps me clean, takes away hunger, and flushes away toxins”; “Mouth gets parched, I feel a little feverish when I don’t drink”; “I don’t feel real, cause I feel empty”; “I don’t know”.

**Question 2.** Why did you cut back on your drinking?—“I was confused due to too much water”; “To avoid going pee so much”; “Because it made me sick to my stomach”; “Dizziness”.

**Question 3.** Why did you start again?—“Because it’s good for me”; “Because I don’t feel human, I feel so weak”; “Because it seemed like the thing to do”; “Because I was anxious and nervous”; “Because it was slow at work”; “Because it is a habit”.

### 4. Discussion

Our study contributes to the understanding of the occurrence of polydipsia in the outpatient population. The prevalence of polydipsia among our outpatients with chronic mental illnesses was 15.7%, close to hospitalized psychiatric patient populations, where rates range from 3% to 25%.

Thirteen patients from the 14 polydipsic patients’ population suffered from Schizophrenia: five patients had disorganized type and the others had paranoid type. All the patients were in partial remission and had been ill for more than 20 years. A French psychiatric team found in 2006 that schizophrenic people with polydipsia and water intoxication presented a particular form of schizophrenia, first described by Kraepelin with a higher level of negative and disorganized symptoms. There seem to be common pathways for polydipsia and schizophrenia, probably associating neuro-developmental and neuro-degenerative mechanisms (Bralet et al., 2007).

All patients were on multiple medications. None of the polydipsic patients were on clozapine, whereas 12 non-polydipsic patients were. One polydipsic subject had a diagnosis of bipolar disorder and was being treated with valproic acid and olanzapine.

Three of the polydipsic patients had associated obsessive compulsive traits. The efficacy of 5HT antagonists in some schizophrenics and evidence of unusual DA metabolism in some OCD patients give rise to the possibility that the metabolism of both monoamines may be altered in both illnesses (Oades et al., 1994). Although we did not find a statistically significant difference, possibly due to relatively low numbers, polydipsia occurred more often in patients with a primary diagnosis of schizophrenia (92.9%) compared to the non-polydipsic group (65.3%). The reasons why polydipsic patients with schizophrenia are more apt to drink excess fluid is not clear. By excluding patients on lithium, we may have excluded some patients with a mood disorder. No patient was suffering from uncontrolled diabetes or being treated with diuretics.

Previous reports suggest that of those suffering from primary polydipsia, up to 31% experience water intoxication, although this number may be even higher (Dixon, 1999). Water intoxication may manifest itself as a worsening of psychiatric symptoms, nausea, vomiting, delirium, ataxia, seizures, and coma, and may even be fatal (Verghese et al., 1993; De Leon et al., 1994). While not significantly significant in our small sample, isolated seizures, urinary incontinence and stomach/bowel complaints occurred more frequently in the polydipsic patients. This underscores the

### Table 1

Demographic Data.

| Demographic Information | Polydipsia (n=14) | No polydipsia (n=75) |
|-------------------------|------------------|---------------------|
| Average age (SD)        | 51.6 years (11.8)| 57.1 years (11.1)   |
| Gender (female)         | 3 21.4           | 18 24.0             |
| Primary Diagnosis       |                  |                     |
| Schizophrenia           | 13 92.9          | 49 65.3             |
| Mood Disorder           | 1 7.1            | 9 12.0              |
| Personality Disorder    | 0 0              | 17 22.7             |
| Smoke Cigarettes (yes)  | 4 28.6           | 23 30.7             |
| Mean (SD) # per day     | 28.8 (7.5)       | 18.7 (9.0)          |
| Alcohol use (yes)       | 4 28.6           | 14 18.7             |
| Drug street use (yes)   | 4 28.6           | 23 30.7             |

| Comorbidities           |                  |                     |
|-------------------------|                  |                     |
| Isolated Seizures (yes) | 3 21.4           | 9 12.0              |
| Osteoporosis/Fractures(yes) | 2 14.3     | 12 16.0             |
| Urinary incontinence    | 6 42.9           | 25 33.3             |
| Stomach/bowel complaints (yes) | 7 50.0 | 22 29.3             |
| Crohn’s disease (yes)   | 3 21.4           | 11 14.7             |

* Statistically significant difference (p < 0.05).

### Table 2

Responses to the questions related to water drinking behavior.

| Questions                                                   | Polydipsia (n=14) | No polydipsia (n=75) |
|-------------------------------------------------------------|-------------------|----------------------|
| Do you think you drink more than average? (yes)             | 9 64.3*           | 15 20.0*             |
| Have you ever felt you should cut down on your drinking? (yes) | 7 50.0            | 20 26.7              |
| Has anyone ever made a comment about your drinking? (yes)   | 6 42.9*           | 14 18.7*             |
| Have you ever felt bad or guilty about your drinking? (yes) | 2 14.3            | 13 17.3              |
| Have you ever been annoyed by criticism about your drinking? (yes) | 3 21.4 | 10 13.3              |

* Statistically significant p < 0.05.

### Table 3

Changes in daily (pm-am) urine specific gravity (× 1000).

| Mann-Whitney U P-value | Polydipsia (n=14) | No polydipsia (n=75) |
|------------------------|-------------------|----------------------|
| USG Change Day 1       | −10.35 (~5.71)    | −3.20 (~4.84)        |
| USG Change Day 2       | −11.07 (~6.84)    | −3.93 (~4.88)        |
| USG Change Day 3       | −11.54 (~2.40)    | −4.47 (~4.47)        |

有意义的差异 (p < 0.05).
need to consider polydipsia and water intoxication in outpatients presenting with these symptoms.

Smoking has been reported to be significantly associated with polydipsia (Dixon, 1999). Comorbidity of both substance abuse (Leucht et al., 2007) and physical disease (Mercier-Guizide and Loas, 2000) has been reported to be highly associated with mental illness. Our findings support a relationship between nicotine consumption and water consumption in an outpatient sample.

The literature suggests that morning and afternoon specific gravities have different predictive potential for polydipsia (low morning is more significant). Only two of our 14 polydipsic patients drank most heavily in the morning. Our outpatient sample was more stable than inpatient cases previously described in literature. Outpatients may have different drinking patterns than inpatients.

The mean quantity of fluid consumption in our polydipsic population was more than 4 l per day. Looking at the changes in their body weight per day, the difference of 4 kg of body weight during the same day could be a consequence of a much greater intake of fluids than the quantity reported by the clients during the structured interview (around 4 l/day—not considering the losses by urine, perspiration, etc.). This raises further issues regarding methods for valid assessment of polydipsia in outpatient settings. Future work might benefit from exploring new methods for tracking fluid consumption in community settings that consider cost, perceived intrusiveness, and staffing issues.

None of the polydipsic subjects had comorbid alcohol abuse. Five of 55 non-polydipsic subjects had a history of alcohol abuse in the past. Four of the polydipsic and 14 subjects of the non-polydipsic group used alcohol occasionally.

Our primary polydipsic patients exhibited limited insight into the extent of their inappropriate water-seeking behavior. Perhaps, even more striking, patients reported that staff and relatives appeared to frequently fail to recognize their excess fluid intake. Only six of our 14 polydipsic patients reported that somebody else, such as friends or medical staff, told them that they were drinking too much. This may have been a function of having fewer close contacts or the patients’ inability or unwillingness to recall this information. Education of staff and family involved in care of these patients may be important for helping to identify polydipsic behavior.

Fluid restriction is often difficult to implement in inpatient settings and is even more challenging in outpatient settings. Group psychotherapy has been shown to decrease fluid intake (Millson et al., 1993). This could be considered for outpatients.

### 4.1. Limitations of the study

Our study was limited to one site and the studied population was relatively small. Caution must be used when generalizing outside of our setting. Larger multi-site studies will be necessary to fully understand the prevalence of polydipsia in outpatients and the impact of the diagnosis on mortality and morbidity in this population.

We did not measure serum sodium levels as it would have reduced the number of patients willing to participate. However, future studies may wish to include serum sodium analysis as it may provide a more accurate profile of polydipsia.

### 4.2. Conclusions

The prevalence of primary polydipsia in our outpatient chronic psychiatric population was 15.7%. The majority of individuals with primary polydipsia are not fully aware of the severity and possible complications of their problem. Given the prevalence of polydipsia more effort should be put into identifying and treating this problem.

### Acknowledgments

Dr. Nicolas Delva provided advice and shared his extensive experience in this field. The enthusiastic COT team helped with data collection, counseled patients, and offered a comfortable environment for the entire length of this project and consisted of Detlef Stein, Michel Herr, Sally Lakes, Doug Patterson, Julie Hicks, Kelly Siobhan, Valerie Thomson, Adriana Farcas, Nasha Vandermeyer. This project was funded by a “Research Initiation Grant” through Queen’s University, Kingston, Ontario, Canada.

### Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.psychres.2013.04.011.

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### Table 4

Results from the structured interview: responses scored on a 5-point Likert scale.

|                        | Polydipsia (n=14) | No polydipsia (n=75) | Mann Whitney-U P-value |
|------------------------|-------------------|----------------------|------------------------|
| How much fluid do you drink in a typical day? 1—very little, 5—very much | 4.21 (0.80) | 3.37 (1.10) | 0.005 |
| How much fluid would you like to drink in a typical day? 1—very little, 5—very much | 3.77 (1.17) | 3.34 (1.01) | 0.205 |
| Do you feel that drinking too much water can damage your health? 1—very little, 5—very much | 2.07 (1.69) | 2.16 (1.38) | 0.632 |
| Have you had any physical problems due to your water drinking? 1—none, 5—many | 2.07 (1.49) | 1.40 (0.88) | 0.052 |
| Has drinking water caused you to act or feel in a different way? 1—never, 5—often | 2.71 (1.68) | 1.47 (1.02) | 0.001 |
| Have you ever felt like cutting back on the amount of fluid you drink? 1—very little, 5—very much | 2.00 (1.11) | 1.61 (0.98) | 0.169 |
| Have you been able to cut back on the amount of fluid you drink? 1—never, 5—often | 2.50 (1.51) | 1.79 (1.10) | 0.087 |
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