Original Paper

Prevalence, Treatment, and Control of Hypertension in Primary Care: Gaps, Trends, and Opportunities

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Since most cases of hypertension are managed in family practice, estimates of the prevalence, treatment, and control in the primary care population are needed to adequately address the burden of hypertension in Canada as it has in other countries. The authors used a large primary care research database to determine the prevalence of hypertension between 2000 and 2003. Blood pressure recordings were used to estimate the rates of prevalence, treatment, and control of hypertension for the overall population and for important subgroups. The prevalence of hypertension was 17.3%, most patients had untreated hypertension (68.6%), and only 15.8% had blood pressure treated and controlled. Higher rates of treatment and control were observed among older adults, those with type II diabetes, and those with a previous myocardial infarction. Odds of achieving target blood pressure were significantly better when combination therapy vs monotherapy was used. The prevalence of hypertension in primary care is high and most patients remain untreated; however, increased risk appears to lead to better treatment and control. (J Clin Hypertens. 2007;9:28–35) ©2007 Le Jacq

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Hypertension is a major risk factor for cardiovascular disease (CVD) in Canada.[1,2] CVD is the leading cause of death and a major cause of hospitalization in Canada.[3,4] Of concern is the observable trend toward increasing risk for hypertension but worsening treatment and control rates.[4] Previous estimates of hypertension prevalence, treatment, and control from the Canadian Heart Health Surveys (CHHS)[1,5] revealed that hypertensive patients are at risk for either lack of treatment or inadequate treatment to recommended targets. Several factors,[6] including evidence-based guidelines dissemination,[7] availability of newer medications with landmark clinical trials,[8] and enhanced blood pressure (BP) detection and education within the community,[9,10] however, may have resulted in improved rates of treatment and control[11] since the time of CHHS (1986–1990).

Inadequate rates of BP treatment and control are in contrast to the overwhelming evidence that hypertension control is associated with significant reduction in cardiovascular events and may be related to gaps in care at the practice level.[12–17] This situation has led to the publication of a Canadian National Strategic Plan[14] for BP control with a goal of reducing the prevalence of uncontrolled BP by 10% by the year 2005. Similar goals have been sought in the United States. Hence, our study had the following objectives: (1) to determine the prevalence of hypertension in a large representative cohort of primary care practice patients; (2) to determine the level of BP control in patients with hypertension, including subgroups of patients older than 65 or those with diabetes or a previous myocardial infarction (MI); and (3) to determine current therapeutic choices of antihypertensive

medications in people receiving treatment and the relationship with evidence-based guidelines.

METHODS

A cohort analysis was performed on a population-based database of more than 150,000 patients in 35 family practice clinics in Southwestern Ontario between April and December 2000 (baseline). Patients were followed prospectively on a quarterly basis until December 2003 as part of a larger study of lifestyle habits and CVD prevalence in primary care.[18] Primary care practices were representative of the general primary care population and ranged from single-physician to multiphysician clinics in both rural and urban settings, with the practice size ranging from 1100–4500 patients.[19]

All clinical data, including visit diagnoses, symptoms, BP, smoking status, height, weight and fitness level, medications, diagnostic testing (ie, electrocardiography and laboratory analyses including blood chemistry), and consultation notes were abstracted at baseline (April–December 2000) in all patients older than 18 years in each practice. Quarterly data entry was conducted until December 2003. Test-retest of selected data entry parameters within practices has been previously reported with a high degree of concordance.[19]

Hypertension Prevalence Analyses

The primary outcome was hypertension prevalence for the entire cohort at baseline. Change in prevalence was also determined during the study period. Hypertension was diagnosed using at least 1 of the following criteria: (1) physician diagnosis and entry of hypertension (text entry or International Classification of Diseases, Ninth Edition, Clinical Modification (ICD9) code for hypertension); (2) at least 2 measurements of BP greater than target values based on patient subgroup (>140 and/or 90 mm Hg for the general population, >130 and/or 80 mm Hg for type II diabetics, >160 mm Hg systolic BP for isolated systolic hypertension [ISH]); or (3) at least 1 prescription for an antihypertensive medication or notation of lifestyle management for hypertension (prescription of antihypertensive medication for non–BP-related conditions was excluded). The prevalence of hypertension was computed by dividing the number of patients meeting the above-mentioned criteria by the total number of patients registered in the database at the time of analysis. Age- and sex-stratified prevalence of hypertension was also computed. Mean systolic and diastolic BP levels were calculated for the entire sample and for subgroups including patients older than 65 years, those with a diagnosis of type II diabetes or a previous MI, overweight (body mass index >27), smoking status, low aerobic fitness level >1 SD below the age and sex mean for the cohort. The frequency of the population by ranges of 10 mm Hg systolic and diastolic BP levels for the subgroups was used to describe the prevalence of the subgroup.

The type of BP device used within the clinic was recorded (ie, mercury sphygmomanometer or automated digital device). If multiple BP measurements were recorded at a given visit, they were averaged and the number of BP entries per visit was captured.

Treatment and Control Analyses

BP control rates were estimated as the proportion of patients who were treated with antihypertensive medication, with or without documented lifestyle management, who met target levels of BP according to the 2001 Canadian Hypertension recommendations,[7] which were released at the time of our baseline data collection. The treatment and control rates were estimated for the entire population and the subgroups described above. BP was further stratified by a choice of antihypertensive medication class (angiotensin-converting enzyme [ACE] inhibitors, calcium channel blockers [CCBs], β-adrenergic blockers), diuretics, and others (ie, α-adrenergic blockers, vasodilators), whether monotherapy or combination therapy was utilized and target thresholds were met.

We computed the annual frequency of physician visits for the total population, patients with a diagnosis of hypertension, patients older than 65 with a diagnosis of hypertension, patients with type II diabetes with a diagnosis of hypertension, patients with controlled hypertension, and patients with uncontrolled hypertension. We estimated the likelihood of achieving BP control using logistic regression based on the following predictors: age (older than 65 or 65 years and younger), sex, previous history of MI, diagnosis of type II diabetes, diagnosis of dyslipidemia,[20] body mass index (>27 or <27), smoking status, and fitness level. Achieving goal BP was further assessed using survival analyses methods.[21] After testing the proportional hazards assumption, a Cox regression model was used to estimate the impact of the previous variables on the class of prescribed drug, achievement, and maintenance of BP during the study period. Differences between groups were assessed using χ^2 statistics and analysis of variance. Significance was considered to be $P<.05$.

Table I. Hypertension Prevalence and Sample Demographics			
Characteristic	No.	Analysis Cohort, %	Hypertension Prevalence, % (No.)
Female	23,688	55.9	19.1 (4514)
Male	22,536	44.1	15.5 (3503)
Type 2 diabetes	10,723	23.2	23.7 (2540)
Older than 65 y	9307	20.1	45
Previous myocardial infarction	3744	8.1	18.8 (706)
Total	46,224		

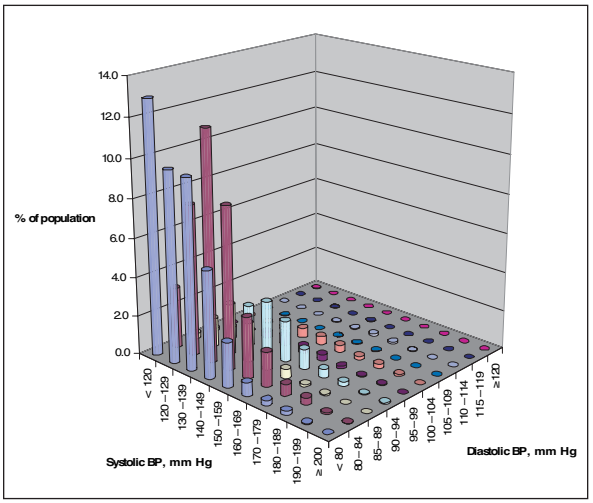

Figure. Frequency distribution for all blood pressure (BP) measurements at baseline.

All statistical analyses were performed using SPSS (version 11, SPSS Inc, Chicago, IL). The study was approved by the University of Western Ontario ethics review board.

RESULTS

Analysis Cohort

The Southwestern Ontario database (N=150,057) included 46,224 patients with baseline BP entries, which formed the analysis cohort. Thirty-four of the 35 practices contributed to quarterly data captured. Data extraction of clinical information at baseline took 9.8±8.1 days per practice while subsequent quarterly abstraction took 2.2±3.1 days. There were significantly more women (55.9%) than men (44.1%) in the cohort, $P<.0001$. The average age was 51±21 years (range 18–97 years), with approximately 18.9% of the analysis cohort older than 65. The duration of hypertension at baseline was 6.9±3.8 years (range 0–28 years). Hypertension prevalence in the analysis cohort was 17.3% (Table I).

The frequency distribution for all BP measurements at baseline is displayed in the Figure. Most patients (41.2%) had diastolic pressures <80 mm Hg, while only 10% had diastolic BPs >90 mm Hg. In contrast, only 16.6% had a systolic BP <120 mm Hg and 35% of systolic BPs were >140 mm Hg, with 33% between 140–160 mm Hg. Twenty-seven percent of patients had a systolic BP between 130–139 mm Hg.

HYPERTENSION TREATMENT AND CONTROL

Overall

Of the hypertensive patients, 68.6% were untreated, 12.8% were treated but not controlled, and 15.8% were treated and controlled (Table II).

Age and Sex

Among those older than 65 years, 56% were untreated, 22.4% were treated but not controlled, and 21.6% were treated and controlled. Among patients 18–64 years, 66% were untreated, 10% were treated but not controlled, and 13.2% were treated and controlled (Table II).

Although women had a higher prevalence of hypertension compared with men (19.1% vs 15.45, respectively), there was no sex difference in the treatment and control rates. A significantly greater number of women (59.4%) older than 75 were untreated compared with men (54.3%; $P<.0001$), however, while similar proportions at this age were treated and controlled for both sex.

Isolated Systolic Hypertension

The distribution of ISH is given in Table III. The prevalence of ISH in the population was 3.74%, with most of these patients (22.3%) older than 65 years. Most patients had untreated ISH (35.1%) or were treated and uncontrolled (59.4%). We were unable to determine the prevalence of treated and controlled ISH because very few chart entries indicated ISH and there was a lack of corroborative ICD9 codes for this diagnosis. Of those patients with a chart entry for ISH, systolic BPs were >160 mm Hg.

CVD Risk Factors

For patients with type II diabetes (23.2%), 69% were treated with antihypertensive medication (56% were taking combination therapy with >2 medications) and 69% achieving target BP in the

Table II. Distribution of Hypertension Treatment and Control by Age and Sex

Age Group, y	No.	Prevalence of Hypertension, % (No.)	Untreated, % (No.)	Treated But Not Controlled, % (No.)	Treated and Controlled, % (No.)
Women					
18–24	2386	1.01 (24)	91.67 (22)	4.17 (1)	4.17 (1)
25–34	4497	3.18 (143)	93.01 (133)	2.80 (4)	4.20 (6)
35–44	4614	6.91 (319)	77.43 (247)	10.03 (32)	12.23 (40)
45–54	3905	16.06 (627)	67.78 (425)	17.70 (111)	13.40 (91)
55–64	2772	31.71 (879)	59.61 (524)	21.84 (192)	16.61 (163)
65–74	2190	48.45 (1061)	53.63 (569)	24.69 (262)	17.34 (230)
75+	3324	43.95 (1461)	59.41 (868)	21.42 (313)	15.33 (280)
Total	23,688	19.06 (4514)	61.76 (2788)	20.27 (915)	15.15 (811)
Men					
18–24	2258	0.97 (22)	95.45 (21)	0.00 (0)	4.55 (1)
25–34	4439	2.00 (89)	83.15 (74)	10.11 (9)	6.74 (6)
35–44	5676	5.36 (304)	74.34 (226)	15.13 (46)	10.20 (32)
45–54	3833	15.73 (603)	66.00 (398)	15.09 (91)	17.25 (114)
55–64	2537	31.26 (793)	55.36 (439)	24.46 (194)	17.02 (160)
65–74	1822	45.44 (828)	54.83 (454)	23.43 (194)	19.08 (180)
75+	1971	43.84 (864)	54.28 (469)	20.02 (173)	20.72 (222)
Total	22,536	15.45 (3503)	59.41 (2081)	20.18 (707)	17.53 (715)
Total cohort	46,224	17.34 (8017)	68.6 (4869)	12.8 (1622)	15.8 (1526)

range of <130/80 mm Hg. Patients with a documented history of MI (8.1%) had a treatment and control rate of 41.6%, whereas only 22.9% were untreated and 33.6% were treated and not controlled. Most patients (62%) were on ≥2 antihypertensive medications in these latter 2 groups.

All patients with a diagnosis of hypertension had at least 1 BP entry in the chart at baseline (20% had ≥2). The number of BP measurements per visit was 0.5±0.3 overall and 1.6±1.1 for those who met our criteria for hypertension. The number of BP recordings among the entire cohort and those with hypertension did not change significantly over the study period. BP measurement was primarily by anaeroid devices (74%), followed by mercury sphygmomanometer (21%) and automated devices (5%), respectively.

Frequency of Physician Visits for Hypertension Patients

At baseline, the number of physician visits among hypertensive patients was 3.2±1.3, with 1.4±0.9 visits specifically for hypertension management. The overall visit frequency was relatively unchanged during the years 2001–2002 and 2002–2003 (3.0 and 3.3 visits per year, respectively). Visits for hypertension management increased significantly to 1.9±1.1 and 2.1±1.3 (P<.001) visits per year, respectively. Thirty-five percent of hypertension patients had only 1 visit per year, compared with 19.7% who had at least 2 visits per year and 14% with ≥3 visits per year for hypertension. Thirty-five percent did not see their physician during 1 year. Visit frequency was greatest for acute medical conditions and those specifically for hypertension management among patients older than 65 years; 53% of patients older than 65 years had at least 2 visits for hypertension per year.

Antihypertensive Treatment Choice

Most patients with hypertension received monotherapy (63%). Among those who received medication (alone or in combination), class prescription prevalence was: ACE inhibitor (28%), CCB (18%), β-blocker (17%), thiazide diuretic (16%), and angiotensin receptor blocker (ARB) (13%). For patients whose BP was treated and controlled, the frequency of monotherapy by class was: ACE inhibitor (34%), CCB (20%), β-blocker (19%), diuretic (17%), and ARB (14%). Patients who were treated and controlled showed age-associated differences in class prevalence. For those patients who received ≥2 medications for hypertension treatment and control, the primary combination included an ACE inhibitor and diuretic (78%), followed by an ARB and diuretic (16%), and an ACE inhibitor and CCB (6%). Very few patients were prescribed a β-blocker and diuretic. Patients older than 65 years received (alone or in combination) ACE inhibitors 63% of the time, ARBs 33%

Table III. Distribution of Isolated Systolic Hypertension (ISH)

Age Group, y	No.	ISH, %	Untreated, %	Treated But Not Controlled, %
Women				
18–24	2386	0.0	0.00	0.00
25–34	4497	0.18	100.00	0.00
35–44	4614	0.51	65.22	26.09
45–54	3905	2.05	53.75	41.25
55–64	2772	7.68	39.91	54.93
65–74	2190	14.57	34.48	60.19
75+	3324	12.15	31.44	64.36
Total	23,688	4.42	37.06	58.07
Men				
18–24	2258	0.09	100.00	0.00
25–34	4439	0.14	83.33	16.67
35–44	5676	0.51	55.17	41.38
45–54	3833	1.72	43.94	48.48
55–64	2537	6.39	22.22	70.37
65–74	1822	11.47	31.58	62.20
75+	1971	10.55	31.25	62.50
Total	22,536	3.03	32.11	61.44
Total cohort	46,224	3.74	35.11	59.40

of the time, CCBs 65% of the time, β-blockers 69% of the time, and diuretics 52% of the time. Changes from baseline for treatment and control were unchanged for drug class preference except for a small increase in diuretics for 2002–2003 and a decrease in ACE inhibitors (P>.05%).

Modeling of Factors Predicting Achievement of Target BP

Older patients with a history of MI or type 2 diabetes were more likely to achieve target BP than younger patients (P<.001) according to the Cox regression model. People with ≥2 concurrent comorbidities were also more likely to achieve target BP than those who had <2 concurrent comorbidities (P<.001). Smokers were more likely to achieve target BP than nonsmokers (P<.04); overweight patients were less likely to achieve target BP than those who were normal or who had achieved ideal weight (P<.02). Dyslipidemia or low aerobic fitness did not affect the levels of target BP control.

DISCUSSION

Previous reports have described hypertension treatment and control rates as poor, with the majority of patients either unaware that they have high BP or are not treated.[1] Our findings indicate that the prevalence of hypertension in the community has increased with a concurrent small improvement in treatment and control. This finding is consistent with more recent reports of a similar increase in prevalence and control rates in some European countries.[11] Further, we observed the best control among patients with higher CVD risk including older adults, those with type II diabetes, and those with previous MI.

These improvements could be the result of several efforts since the last Canadian Heart Health Surveys.[1,5,14] These efforts may have included a coordinated recommendations process for hypertension control[7] as well as other governmental, pharmaceutical, and continuing health education activities aimed at groups with a higher risk for CVD. Whether these efforts could serve as models for improvement among the more general hypertensive populations where challenges in awareness and perception of risk are prevalent is unknown.[22]

Although we observed some improvement at baseline in treatment and control from previous estimates and during the follow-up period, there remains a significant gap in achieving the proposed reduction in hypertension prevalence of 10% by the year 2005.[14] Our findings appear to suggest instead that there is a risk for continued suboptimal prevention and control of BP in Canada. Despite the demonstrated importance of treating hypertension[23,24] and the dissemination of national strategies for prevention and control, there has not been a significant concomitant improvement in hypertension treatment and control rates[1,6,11] for the majority of Canadians.

We observed some encouraging trends, however. First, although the prevalence of uncontrolled hypertension increased with age, rates of control improved with increased age. This observation is contrary to previous reports that physicians tend to use thresholds above recommended targets for initiating treatment among older patients[25,26] but is consistent with more recent reports in Europe.[11] Second, even though better control rates were observed in older adults, we observed that women received less effective treatment for elevated BP at an older age than men in contrast to recent European analyses.[11] Sex and age should be a major focus of hypertension control in the future.

Patients with increased CVD risk including those with type II diabetes and previous MI had better rates of treatment and control of hypertension (41% and 69%, respectively) than our general cohort population. These results are consistent with a previous report in Canada[1] that noted 5% of patients with lower CVD risk were treated and controlled compared with 12% among those with higher risk. These Canadian findings and our results are in contrast to more recent reports from some countries in Europe (Spain and England) where treatment and control was low among patients with very high risk (between 1% and 4%) but was also lower among the general population in these countries compared with Canada.[11] Our findings suggest that there has been some impact of implementation strategies of treatment to target in the primary care setting among those at higher risk. Of concern is that concentration on high-risk patients may limit the public health impact of BP control; the burden of BP may be primarily in the high–normal range and among lower cardiovascular risk persons who make up most of the population-attributable risk.[27] This further reinforces the importance of continued improvement in BP prevention, screening, treatment, and control in the general population. We have previously reported good general knowledge of risk factors for high BP in the community; however, the community has also failed to appreciate high BP as a significant health risk.[28] Furthermore, when public awareness programs have been implemented, there has been only short-term improvement in BP knowledge in the community.[22] Although the reasons for a gap in BP control is likely to include many facets at the patient–provider interface, it may be that clinical inertia or failure of health care providers to initiate, discuss, and intensify therapy (we found that most patients were receiving monotherapy) may contribute to the problem.[29–31]

The increased frequency of BP visits in our study following the release of the 2001 Canadian Hypertension Guidelines[7] suggests that delivery of evidence-based recommendations on a yearly basis may have an ongoing impact on BP control. Emphasis on individualized therapy recommendations was reflected in the observed distribution of drug class choice, with ACE inhibitors as the predominant selection. As a surrogate for BP control, Campbell and colleagues[32] observed increased prescription rates for ACE inhibitor and diuretic therapy as a result of the guidelines released at that time. Our results, however, did not show a significant increase in diuretic class choice after the release of Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT),[8] which reported that coronary heart disease outcomes were similar with these agents compared with CCBs or ACE inhibitors and confirmed that findings from randomized control trials (on which evidence-based guidelines are determined) may not necessarily reflect actual physician/patient behavior at the point of care.[33–38] Achieving BP target is likely associated with complex determinants (eg, age, other comorbid illness, presence of coronary artery disease). It is encouraging that achieving target BPs with different antihypertensive classes was consistently related to these patient-related factors across medication choices and that it appears that patients at highest risk appear to achieve better BP control. In addition to public health and provider awareness and education efforts, hypertension guidelines will continue to be an important component of the strategy to control BP.[39]

Our data are similar to a previous report among older patients in the Ontario Drug Benefit Formulary,[40] where prescribing frequency for β-blockers was between 12% and 16%, compared with ACE inhibitors at 27%–32% and CCBs at 14%–23%; however, we observed low diuretic use of 17% compared with the 33%–38% reported by these authors.[38] In contrast to previous reports of cardiovascular medication utilization and the release of the ALLHAT clinical trial results,[8] diuretics were used less than other antihypertensive classes. This finding is also remarkable given that Tu and associates[40] reported an increase of more than 400% in prescribing of the ACE inhibitor ramipril among older patients following publication of the Heart Outcomes Prevention Evaluation (HOPE) trial results. The choice of antihypertensive medication may have been influenced by the intensive marketing of newer drugs, as was the case with ARBs, but also is consistent with changes in some

of the practice guidelines. The most recent iteration before 2000 (when data collection was initiated in our study) for hypertension therapy guidelines was based on a stepped-care principle with diuretics or β-blockers as first-step drugs with additional drug therapy prescribed as needed. Further, it was recommended at that time that ineffective drugs be replaced with single-drug therapy from another category. This recommendation may explain some of the low use of diuretics as well as low use of combination therapies and higher use of CCBs, ACE inhibitors, and ARBs, which may have been perceived by physicians as more potent monotherapy choices despite abundant data from the clinical trials. The choice of antihypertensive agents among men and women were similar except for reduced diuretic and β-blocker use among men.

Our findings were consistent with those of Wolf-Maier and colleagues[11] who reported a decrease in the prevalence of hypertension (29.9% to 26.6%) between 1985 and 1995, but an increase in uncontrolled hypertension from 32.6% to 57.4% among men and 38% to 42.6% among women. Further, Wolf et al[11] also observed a significant increase in the use of CCBs from 19.7% to 21% and ARBs from 5.2% to 25.4%, with a decrease in the proportion of patients receiving diuretics from 31% to 17.2%. There was also reduction in the proportion of patients who received combination medications, from 39.6% to 15.6%. It is of interest that the change in treatment practice may have had some impact on the less favorable outcomes.

A major strength of our study was that we were able to compare and describe a large cohort of patients in primary care over 3 years of comprehensive, inclusive clinical data collection. This data collection also coincided with the release of major clinical trial results and evidence-based recommendations that would reflect the usual BP management in the community. It may be considered that our treatment and control rates in high-risk patients were unexpectedly high; however, previous reports of cardiovascular risk management in the same geographic region have noted similar results.[41] Our cohort was composed of representative primary care practices and patients in Southwestern Ontario since both urban and rural settings were solicited from a range of practice settings. Hence, this provides a reasonable benchmark of hypertension in the Canadian point of care.

BP control was based on criteria related to the documented diagnosis of hypertension, medication prescription, and BP measurement. We did not rely solely on diagnostic coding as used in administrative databases. While the majority of BP measurements per visit were low, these values were averaged when available. Our data collection methods were homogeneous across practices, while the type of BP device was consistent per practice. A significant limitation was our inability to adequately capture the treatment and control of ISH. The number of text entries of ISH was low because there was no corroborative ICD9 code for this diagnosis. We believe that our data reflect actual practice behavior as opposed to an "artificial setting" as described in clinical trials. Indeed, the low reproducibility of findings from experimental studies has led health care providers to seek new sources of assessing the appropriateness of medical care in actual practice settings.[42]

Although health care claim databases provide an opportunity to perform pharmacoepidemiologic studies,[43,44] they also have a number of limitations, including the so-called presence of the primary disease based on prescription or service coding. Actual practice setting data abstraction permits coded data as well as text clinical diagnoses and corroboration by physical measurement, recording of associated symptoms, and listing of multiple concurrent diagnoses and, hence, a better sense of the true behavior of disease burden in the community. We have described the usual care of BP management at the point of care. Hypertension prevalence is increasing while treatment and control remains a challenge. Our findings may provide a framework to support future intervention as well as target gaps and successes for ongoing efforts toward BP management.

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