

Type 2 diabetes in family practice

Room for improvement

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ABSTRACT

OBJECTIVE To further knowledge of diabetes management in family practice.

DESIGN Retrospective, observational chart audit study.

SETTING Southwestern Ontario.

PARTICIPANTS A random sample of non-academic family physicians and a random selection of their patients with type 2 diabetes mellitus.

MAIN OUTCOME MEASURES Glycemic control as measured by HbA_{1c} and adherence to recommendations in clinical practice guidelines (CPGs).

RESULTS Eighty-four percent of patients had at least one HbA_{1c} test ordered in the previous year. Overall mean HbA_{1c} was 0.079 and half the patients had levels deemed acceptable by 1992 CPGs. Screening for microvascular complications was disappointing; only 28% were tested for microalbuminuria, and 15% were examined for diabetes-related foot conditions. Screening for macrovascular complications was more comprehensive; blood pressure was measured in 88%, and lipid profiles documented in 48%, of patient charts.

CONCLUSION Management of glycemic control and screening for microvascular and macrovascular disease in family practice can be improved.

RÉSUMÉ

OBJECTIF Mieux savoir comment se traite le diabète en pratique familiale.

TYPE D'ÉTUDE Étude d'observation rétrospective par examen des dossiers.

CONTEXTE Sud-ouest de l'Ontario

PARTICIPANTS Un échantillon aléatoire de médecins de famille non universitaires et une sélection aléatoire des diabétiques de type 2 dans leur clientèle.

PRINCIPAUX PARAMÈTRES ÉTUDIÉS Contrôle de la glycémie par dosage de l'HbA_{1c} et respect des recommandations des lignes directrices de pratique clinique (LDPC).

RÉSULTATS Quatre-vingt-quatre pour cent des patients avaient eu au moins une mesure de l'HbA_{1c} durant l'année précédente. La valeur moyenne pour l'ensemble était de 0,079, la moitié des patients ayant des niveaux acceptables d'après les LDPC de 1992. Le dépistage des complications microvasculaires était moins satisfaisant; 28% seulement avaient eu une mesure de la microalbuminurie et 15% seulement une recherche de lésions diabétiques aux pieds. Le dépistage des complications macrovasculaires était plus adéquat; d'après les dossiers, la tension artérielle avait été mesurée dans 88% des cas et un profil lipidique avait été obtenu dans 48% des cas.

CONCLUSION Le contrôle de la glycémie et le dépistage des complications micro- et macrovasculaires peuvent être améliorés en pratique familiale.

This article has been peer reviewed.

Cet article a fait l'objet d'une évaluation externe.

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Approximately 1.5 million Canadians have diabetes (5%); most of them have been diagnosed with type 2 diabetes mellitus (DM).¹ This figure likely underestimates the true number of family practice patients with type 2 DM by at least 2.2%.² Most of these patients rely on their family physicians to manage their diabetes care. The complexity and chronic nature of diabetes present special challenges for family physicians whose clinical goal is to prevent or reduce diabetes-related complications.

Effective diabetes management can reduce the occurrence and progression of many of these complications.³⁻⁸ To this end, expert advisory committees in Canada and most industrialized nations have developed clinical practice guidelines (CPGs) for primary care physicians to promote comprehensive care and management of patients with type 2 DM. In Canada, two sets of CPGs for diabetes care have been published. The Canadian Diabetes Advisory Board in association with the Canadian Diabetes Association published the first set in 1992.⁹ These were revised in 1998 and converted into evidence-based, graded CPGs, which supported more aggressive screening and treatment for diabetes and related complications.¹

The effect of these guidelines on Canadian family practice has been underresearched. Worrall and colleagues,¹⁰ who evaluated diabetes management among family physicians in Newfoundland, suggested that CPGs had not been fully applied. Greater understanding of the current level of care of patients with diabetes in family practice is needed. The purpose of this study was to determine how closely physicians

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adhere to diabetes CPGs in Canada. We report the baseline chart-audit results of a randomized controlled trial evaluating an educational intervention.

METHODS

Participants

Participating physicians were identified through the Thames Valley Family Practice Research Unit (TVFPRU) registry, a comprehensive database of all family physicians actively practising in a five-county area (Elgin, Huron, Middlesex, Oxford, Perth) within southwestern Ontario. To qualify for the study, physicians had to work more than 25 hours weekly in a non-academic practice and to treat patients with type 2 DM. Physicians from the TVFPRU registry were stratified by location of practice (urban, rural, or semirural), randomly ordered by computer, and recruited by peers.¹¹

In each participating practice, a register was produced using the International Classification of Disease billing code 250¹² for patients who had consulted a physician in the previous 12-month period. Patients were eligible if they had been diagnosed with type 2 DM at least 2 years before study commencement, had not been pregnant in the past 2 years, and were competent to consent. The register was ordered alphabetically, enumerated, and the random selection feature of SPSS¹³ was used to choose 30 patients. These patients were mailed a letter from their family physicians requesting consent. The identity of both recruited and consenting patients was not divulged to their physicians. The study protocol was approved by The University of Western Ontario Research Ethics Board for the Review of Health Sciences Research Involving Human Subjects.

Measures

Outcome measures included glycemic control as measured by HbA_{1c} and fasting glucose and physicians' adherence to CPG recommendations. In addition, number of office visits; smoking status; current medications for diabetes; and patients' age, sex, and date of diagnosis were noted. Physicians' practice location and setting, sex, years in practice, and certification status with the College of Family Physicians of Canada were documented.

The investigators designed a Microsoft Access audit database incorporating the 1992 CPGs. A maximum of 15 charts from consenting patients were randomly chosen for audit using SPSS.¹³ Two auditors, trained using sample charts, entered data

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directly onto laptop computers at physicians' offices. Adherence to each recommendation was documented if there was supporting notation in the chart. No personal identifiers were recorded. A 12-month period of visits within the time frame of March 1997 to February 1999 was audited.

Analysis

Sample size was determined using pilot-study data to assess, with a 95% confidence level, adherence to several dichotomous CPG recommendations; number of charts ranged from 88 to 171.¹⁵ Thus, if 30 physicians each contributed 10 patients, up to 43% of patients could withdraw without invalidating the study.

Data were analyzed using the SPSS statistical package.¹³ Demographic and audit data were summarized using descriptive frequencies or means with 95% confidence intervals (CI).

RESULTS

Participants

Of 95 randomly selected family physicians, 87 were contacted, 79 of those were eligible, and 29 consented (36.7%). An average of 33 eligible patients per physician were identified; mean consent rate was 62.5%. A total of 331 charts was audited, a mean of 11.4 charts per physician. Stratification ensured that 48.5% of participants were practising in semiurban or rural areas. Demographics of study participants, non-participants, and the TVFPRU registry are described in **Table 1**.

Patients were predominantly female (175, 53%); 156 (47%) were male. Mean age was 65.3 years (range 28.6 to 97.8, SD=11.6), and mean duration of DM was 8.7 years (range 1 to 41 years, SD=6.0).

Table 1. Demographics of participating physician

CHARACTERISTICS	PARTICIPANTS N=29	NON-PARTICIPANTS N=50	TVFPRU N=399
Male	51.9%	75.5%	72.7%
CCFP certificants	69.0%	38.0%	48.9%
Years since graduation (mean)	19.7	20.8	20.7
In group practice	82.8%	59.6%	56.4%

TVFPRU—Thames Valley Family Practice Research Unit.

Chart audit

Mean number of patient visits per physician over 1 year was 9.4 (95% CI: 8.6 to 10.2, median: 8.0). In

60% of visits, a mean of 5.0 visits (95% CI: 4.6 to 5.5, median: 4.0) for diabetes care was documented.

Seventy-five percent (N = 246/326; 6 missing records) of patients had received some education regarding diabetes since the time they were diagnosed. Most patients (142, 58%) received their education from a diabetes educator at a diabetes education centre; 38 patients (15%) were referred to a dietitian as well. Sixty-four (26%) were referred to a dietitian only. Two patients were educated as inpatients.

Since their diagnosis, 47% (N = 154/328; 3 missing records) of patients had at least one referral to a diabetes specialist (internist or endocrinologist). During the 12-month audit, 23.1% (N = 75/325; 6 missing records) of patients visited a diabetes specialist (mean: 2.2 visits, median: 2, 95% CI: 1.8 to 2.5).

Glycemic control was measured by Hb A_{1c} in 84% of patients; mean measurement was 0.079. When categorized according to the 1992 CPGs, 18.5% were *optimal*, 50% were *acceptable*, and 31.5% were *compromised*. Fasting blood glucose was documented in 67% of the charts, with a mean value of 8.8 mmol/L. **Table 2** summarizes results of the 1-year audit.

Figure 1 shows the distribution of medication regimens. Two hundred twenty-five (68%) patients were prescribed oral diabetes medications: 137 (61%) were prescribed one oral agent; 86 (38%) were prescribed two; and two (1%) patients were prescribed three. Sixty-five patients (19.6%) were prescribed insulin. Of 50 patients with documentation for frequency, 18% (9) injected insulin once daily and 82% (41/50) more than once daily. Of the 39 patients with dosing documented, mean total was 50 U/d. Antihypertensive medications were prescribed for 67.2% (219/326; 5 missing) of patients. Lipid-lowering agents were prescribed for 21.1% of patients.

DISCUSSION

This study confirms, "diabetes is a family practice disease."¹⁴ Family physicians manage laboratory and preventive care for most patients with type 2 DM. Only 23% of patients visited DM specialists during the audit period. Further, this study reveals that family physicians see these patients frequently with a mean of nine visits per patient yearly; diabetes care is documented in 60% of these visits. This was consistent with other findings. Worrall and colleagues¹⁰ documented an average of 13 visits over a 12-month period. This suggests that the Canadian health care system offers ample opportunity for clinical diabetes management according to CPGs.

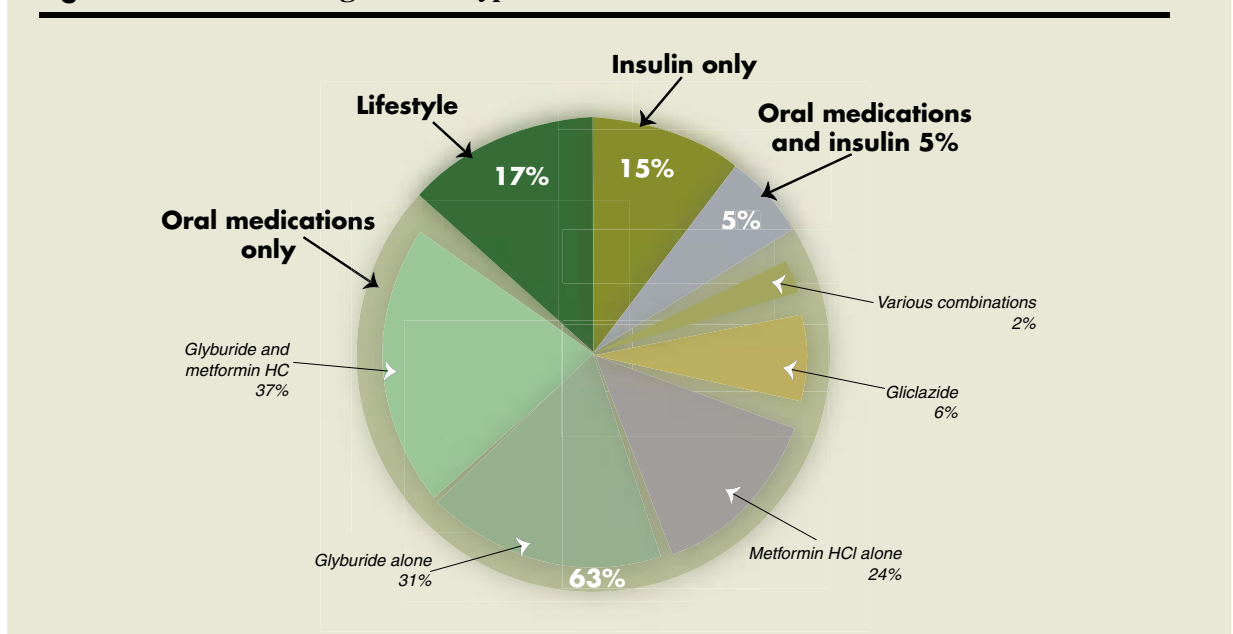
Table 2. Adherence to CPG recommendations for diabetes management

GUIDELINE RECOMMENDATION*	CHARTS INDICATING ADHERENCE (%)	95% CONFIDENCE INTERVAL
GLUCOSE MONITORING		
Patients self-monitor blood glucose (224/326)	68.7	63.7-73.7
HbA _{1c} tested once (277/331)	83.7	79.7-87.7
HbA _{1c} tested twice (190/318)	59.7	54.3-65.1
Fasting glucose tested (220/330) [†]	66.7	61.6-71.8
HbA _{1c} mean value (n=276)	0.079	0.077-0.081
Fasting glucose mean value (n=218)	8.8	8.4-9.2
MACROVASCULAR COMPLICATION PREVENTIVE MEASURES		
Weight recorded at every visit (173/327)	52.9	47.5-58.3
Smokers counseled to quit (16/39)	41.0	25.6-56.4
Blood pressure checked at every visit (288/326)	88.3	84.8-91.8
Electrocardiography performed among those with hypertension (71/222)	32.0	25.9-38.1
Complete lipid profile determined (158/329)	48.0	42.6-53.4
Total cholesterol levels determined (187/329)	56.8	51.4-62.2
MICROVASCULAR COMPLICATION PREVENTIVE MEASURES		
Dipstick urine or urinalysis test performed (147/328)	44.8	39.4-50.2
24-hour urine or albumin:creatinine ratio test performed (91/326)	27.9	23.0-32.8
Examination by ophthalmologist or optometrist within 24-month audit period (153/330)	46.4	41.0-51.8
Examined for peripheral neuropathy (119/331)	36.0	30.8-41.2
Feet examined twice (49/331)	14.8	11.0-18.6

*12-month audit period unless otherwise indicated (raw data).

[†]Includes plasma glucose and glucose measures from patient and office glucose meters.

Figure 1. Medication regimen for type 2 diabetes



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It is difficult to compare the status of type 2 DM management in the audit literature. Varying audit time frames, patient eligibility criteria (ie, mixed reports including type 1 and type 2 DM, or type 2 on medication only), location of practices audited (country), and year of the chart review all influence results.

In our study, family physicians clearly monitor glycemetic control adequately: 84% of all patients had documented HbA_{1c} tests at least once a year, and 60% of patients twice a year. Chesover and associates¹⁵ published a 24-month audit of chart notes (1986-1988) from urban practices in the United Kingdom and reported a 32% HbA_{1c} test documentation rate in patients not prescribed insulin. In a similar setting, again with patients not using insulin, Tunbridge and co-workers¹⁶ published a 12-month audit and reported an 87% HbA_{1c} test documentation rate. Martin and colleagues¹⁷ published a 24-month audit from an urban health maintenance organization in the United States and reported a 69% HbA_{1c} test documentation rate in medicated patients with type 2 DM. Zoorob and Mainous¹⁸ published a 36-month audit on rural practices in the United States and reported a 15% HbA_{1c} test documentation rate among patients with type 2 DM. Recently, Campbell and associates¹⁹ published a 14-month audit from a representative sample of practices in the United Kingdom and reported an 87% HbA_{1c} test documentation rate in medicated type 2 DM patients. In the only Canadian publication, Worrall and colleagues¹⁰ published a 12-month audit on a sample of urban and rural practices in Newfoundland and reported a 53% HbA_{1c} test documentation rate in patients with type 2 DM. Miller and Hirsch²⁰ published a 16-month audit from urban primary clinics in the United States and reported a 64% annual HbA_{1c} test documentation rate for one test and 40% for two.

The mean HbA_{1c} in this study was 0.079. This level is lower than in other published studies in primary care settings. Worrall and colleagues¹⁰ reported 0.081 and Miller²⁰ reported 0.115. This level was *acceptable* according to the 1992 Canadian Diabetes Advisory Board CPGs (**Table 3**). Stricter glycemetic

control is advocated in the revised CPGs of 1998,¹ reflecting an improved understanding of the role of hyperglycemia in development of microvascular complications.^{3,7,8,21} When 1998 CPG targets were applied, the proportion of patients dropped from 68.5% in the *optimal* and *acceptable* categories to 25.7% in the *ideal or optimal* category (**Table 3**). Eighty-six percent of patients considered to have *acceptable* control by the 1992 CPGs were newly classified as *suboptimal*. This reassessment further emphasizes the importance of disseminating new CPG recommendations and of more aggressively maintaining glycemetic control.^{1,22}

Overall, physicians performed poorly in screening for microvascular complications, in particular, examination of feet (14.8%, **Table 2**). This simple clinical procedure has been shown to reduce the rate of amputation significantly.²³⁻²⁵ Neuropathy and retinopathy screening were also lower than 50% (**Table 2**). The rate of microalbuminuria screening for nephropathy^{1,9} was also disappointing: 45% of patients had a urinalysis documented, but only 28% of patients received either an albumin:creatinine ratio or timed urine test. This limited screening for nephropathy is consistent with the literature.¹⁵ Miller and Hirsch,²⁰ for example, reported 42% of charts documented a urinalysis, and only 5% completely documented a 24-hour urine measurement. This area of family practice clearly needs improvement in light of the growing importance of microalbuminuria as an independent risk factor for cardiovascular disease.^{26,27}

Overall, physicians performed much better in screening for macrovascular complications. Blood pressure was measured consistently and was recorded in 88% of patient charts. These findings are similar to other studies. Worrall and colleagues¹⁰ found 100% of patients had blood pressure documented. Tunbridge¹⁶ and Campbell and associates¹⁹ reported 87% and 93%, respectively. Blood pressure measurement appears, therefore, to have been systematically incorporated into routine family practice care. Screening for lipids was less frequent. Total cholesterol was measured in 56% of patients; a full lipid profile was ordered for 48% of patients in this

Table 3. Distribution of HbA_{1c} by 1992 and 1998 standards showing glycemetic control (N=276)

DISTRIBUTION CATEGORY	1992 CPGS: OPTIMAL	1998 CPGS: IDEAL/OPTIMAL	1992 CPGS: ACCEPTABLE	1998 CPGS: SUBOPTIMAL	1992 CPGS: COMPROMISED	1998 CPGS: UNACCEPTABLE
HbA _{1c} assay	<0.066	<0.07	0.066-0.084	0.07-0.084	>0.084	> 0.084
Number of patients assigned to category	N=51 (18.5%)	N=71 (25.7%)	N=138 (50%)	N=118 (42.8%)	N=87 (31.5%)	N=87 (31.5%)

CPGs—clinical practice guidelines.

study (Table 2). Zoorob and Mainous¹⁸ in their study reported 45% of patients had had cholesterol or lipids tested. Worrall and colleagues¹⁰ and Martin and colleagues¹⁷ specifically reported that 63% and 76%, respectively, had had total cholesterol tests; 34% and 59% had had lipid profiles ordered. Attention to identifying and managing dislipidemia in diabetes has increased.^{1,28}

Family practice has been inundated with CPGs over the last decade.²⁹ Guidelines have been published in response to a perceived need to reduce variation in practice, incorporate recent evidence, and manage and control health care costs.^{30,31} As the findings presented here show, it is often difficult to bring clinical practice in line with scientific evidence by disseminating guidelines alone. Numerous barriers to CPG implementation have been identified³²⁻³⁴ and include those internal to physicians: lack of clinical skills³⁵ because of educational barriers³³; ineffectual CME³⁶; distrust of or disagreement with CPGs; reimbursement judged as inadequate³⁷; time constraints; and patient load.³⁷ Barriers external to physicians include individual patient needs, limited systems to support chronic disease management,^{36,38} and poor patient adherence to treatment.³⁶ While physicians recognize the value of CPGs,^{39,40} difficulty arises applying specific recommendations to individual patients¹⁴ and is influenced, to a degree, by patient-centred^{41,42} and health system barriers.^{14,43,44} Thus, additional research focusing on innovative strategies for disseminating and implementing CPGs more effectively in family practice is needed.

Limitations

Our study had several limitations that could affect the generalizability of results. Physicians and patients were randomly recruited, but consent could reflect a participation bias. Participants might have had a special interest in management of diabetes, which could have inflated our results. Our consent rate was 36%, however; when we compare it with other published studies using similar methods, it is consistent (34% to 47%).⁴⁵⁻⁴⁷ Certificants of the College of Family Physicians of Canada, female physicians, and physicians in group practice are overrepresented in our sample compared with numbers reported in the Janus Project survey⁴⁸ and the TVFPRU registry (Table 1). Female sex and certificant status have been associated with higher-quality care.⁴⁹ Solo practitioners work longer hours⁵⁰ and might have declined participation

Editor's key points

- This study examined community family physicians' performance in managing type 2 diabetes as compared with 1992 clinical practice guidelines (CPGs) in southwestern Ontario.
- Hemoglobin (HbA_{1c}) was measured in 84% of patients with a mean of 0.079; mean fasting blood sugar was 8.8. By 1992 CPGs, 19% of patients had optimal control, 50% acceptable control, and 32% insufficient control and, therefore, compromised health.
- Macrovascular screening was fairly good: 88% of patients had blood pressure checked and 48% had lipid levels measured; microvascular screening was less successful; only 28% of patients were tested for microalbuminuria, and only 14.8% had foot examinations.
- Diabetes CPGs appear to have had little effect on the way this group of family physicians manages diabetic patients. New strategies are required.

Points de repère du rédacteur

- Cette étude voulait établir à quel point les médecins de famille du sud-ouest de l'Ontario se conforment aux les lignes directrices de pratique clinique (LDPC) de 1992 dans leur façon de traiter le diabète de type 2.
- L'hémoglobine glycosylée (HbA_{1c}) avait été mesurée chez 84% des patients, la valeur moyenne étant de 0,079; la glycémie à jeun était de 8,8 en moyenne. Selon les LDPC de 1992, 19% des patients avaient un contrôle adéquat, 50% un contrôle acceptable et 32%, un contrôle inadéquat, avec des conséquences adverses pour la santé.
- Le dépistage des complications cardiovasculaires était assez bien fait : la tension artérielle avait été mesurée chez 88% des patients et le bilan lipidique, déterminé dans 48% des cas; le dépistage microvasculaire était moins satisfaisant; seulement 28% des patients avaient eu une épreuve de microalbuminurie et 14,8%, un examen des pieds.
- Chez ce groupe de médecins de famille, les LDPC concernant le diabète semblent avoir peu d'influence sur la façon de traiter ces patients. De nouvelles stratégies s'imposent.

for this reason. Chart audit is an accepted method of measuring physician performance,⁵¹ but it might underestimate some physician behaviours, especially counseling and physical examination.⁵² These types of activities, which might have occurred in clinical encounters but not been recorded on charts, could be underreported in our study.

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Conclusion

This study found that a randomly selected cohort of family physicians inconsistently followed recommended diabetes CPGs. Numerous studies have previously identified limited adherence to diabetes CPGs. Glycemic control was deemed *optimal* or *acceptable* (68.5%) according to the 1992 CPGs, which were current at the time of this study. When 1998 CPG targets were applied, however, 85% of those in the *acceptable* category were newly classified as *sub-optimal*. The overall Hb A_{1c} mean of 0.079 was lower than most other studies in the literature. Family physicians are much better at screening for macrovascular disease than microvascular disease.

Clinical practice guidelines can be considered effective only insofar as they result in improved patient care.³⁴ To date, diabetes CPGs appear to have had little effect on physicians' behaviour.⁵³ Studies such as ours have identified suboptimal diabetes management in family practice; the challenge now is to develop effective methods to translate CPGs into practice to enhance diabetes care in Canada. ❁

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Contributors

Dr Harris was Principal Investigator; was integral to the hypothesis, development, funding, design, implementation, and analysis of the study; and was central to conception, writing, and editing of this paper. **Dr Stewart, Dr Brown, Dr Wetmore, and Dr Faulds**, the Co-Investigators, were integral to development, funding, and design of the study and to physician recruitment and participated in editing and revising this paper.

Ms Webster-Bogaert was essential to implementation and analysis of the study and participated in writing and editing this paper. **Ms Porter** was essential to implementation of the study and participated in editing and revising this paper.

Competing interests

None declared

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