

# The Impact of Implementing a Chronic Care Residency Training Initiative on Asthma Outcomes

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## Abstract

### Purpose

To examine the impact of a chronic care residency training intervention on continuity clinic patients' asthma-related emergency department use and primary care residents' application of key elements of the Chronic Care Model (CCM).

### Method

In 2002 and 2003, the authors conducted a pre- and posttraining survey of 41 intervention residents at Maine Medical Center to assess residents' implementation of the CCM. The change in implementation for intervention residents was compared with that of 77 primary care residents not receiving CCM training. Asthma-related emergency department (ED) use by 441 patients

cared for by intervention residents was compared with that of other asthma patients at Maine Medical Center using hospital billing records.

### Results

At baseline, residents in both groups reported sporadic application of key elements of the CCM. At posttest, Maine Medical Center residents reported significantly greater increases in CCM implementation than the comparison group for 4 out of the 12 items. The greatest increases were in residents' access to asthma guidelines, the proportion of patients receiving written asthma management plans, and residents' access to information on community asthma programs. The number of asthma-related ED visits

dropped significantly among patients treated by intervention residents (pediatric patients 42%, adults 44%). There was a slight increase in asthma ED use for nonintervention pediatric patients at the hospital (8%) and a very small decrease for adults (3%).

### Conclusions

Chronic care training programs for residents may influence the health outcomes of patients treated in their continuity clinics while simultaneously offering an important educational experience in an underemphasized area of medicine.

Acad Med. 2007; 82:161–167.

**A** landmark study in 1996 estimated that 46% of noninstitutionalized Americans live with at least one chronic illness and that treatment for those with chronic illness accounts for over three quarters of all medical expenditures.<sup>1</sup> Despite the high prevalence and cost of chronic disease, many physicians do not receive adequate training in treating chronic illnesses. A national survey of practicing physicians found that most physicians felt that they received less training in chronic care skills than they

needed, given their current practice demands.<sup>2</sup> In the same study, fewer than half reported that their training left them "feeling positive" about taking care of patients with chronic illness. Another national survey found that only half of primary care residents finishing their training reported feeling "very prepared" to treat chronically ill patients.<sup>3</sup>

Consistent with these findings, studies examining the quality of chronic illness care have documented a large gap between optimal and actual physician care. McGlynn and colleagues,<sup>4</sup> in their widely cited study on quality of care, documented that physicians adhere to quality indicators for chronic illness care only 56% of the time. The disease management industry has capitalized, in part, on this poor performance. They have developed what is now a \$600 million industry that provides patients with chronic illness self-management assistance by telephone or Internet, entirely independent of the physician or medical team.<sup>5</sup>

Wagner and colleagues<sup>6</sup> argue that significant improvement in the quality of chronic care requires not only remedying

the deficiencies in physicians' training but also substantially changing the culture and structure of medical practice. Whereas the U.S. health care system was developed primarily to diagnose and treat acute illnesses, treatment of chronic illness requires a different structure to facilitate more collaboration with patients and better population-based information. On the basis of an extensive review of the evidence base, Wagner and colleagues have developed a multidimensional model for restructuring the health care system to more appropriately address the needs of the chronically ill.

The aim of the Chronic Care Model (CCM) is to get "informed and activated patients" to interact with "prepared and proactive practice teams."<sup>7</sup> The CCM focuses on improvement in six key areas: (1) partnering with local organizations that provide chronic illness-related resources and linking patients to these resources, (2) instilling a culture of quality improvement throughout the health care organization, starting with senior management, (3) providing

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Table 1

**Common Elements of a Chronic Care Improvement Intervention by Organizational and Teaching Emphasis, Maine Medical Center, Portland, Maine, 2002–2003**

Intervention emphasis	Chronic Care Model component				
	Community resources and policies	Self-management support	Decision support	Delivery system support	Clinical information systems
Organizational component	Partnerships with local and state asthma initiatives	Individual patient sessions with asthma educators	Guidelines embedded in electronic health record	Planned visits and follow-up	Creation of asthma patient registry
Teaching component	Offsite visits to homes and agencies	Residents participated in the sessions with asthma educators	Chart review applying guidelines and reviewing evidence	Didactic sessions on optimal use of these visits	Use of registry to conduct continuous quality improvement projects and monitor panels of patients

ongoing support for patients to self-manage their chronic conditions, (4) designing the delivery system so that patients receive structured and planned care oriented towards maintaining health, rather than reacting to acute episodes, (5) developing systems to embed evidence-based guidelines into clinical practice, and (6) utilizing information technology to improve care through sending patients reminders, identifying subpopulations for proactive outreach, and monitoring provider performance.

Although the CCM was developed by reviewing the literature and it has strong face validity, rigorous testing of its implementation is warranted.<sup>8–10</sup> Other investigators are currently studying the effectiveness of learning collaboratives in promoting implementation of the CCM in 37 clinic sites and the impact of its implementation on cost and care outcomes.<sup>10,11</sup> In our study, we focus on an academic teaching center, the Maine Medical Center in Portland, Maine, to assess whether a resident training program incorporating implementation of the CCM specifically for improving asthma care can have a positive impact on resource use for patients in the program's continuity clinics. We examine the impact of the CCM training intervention both on residents' access to and use of elements of the CCM and on patients' asthma-related use of the emergency department (ED) for treatment.

## Background

The Chronic Care Collaborative was developed and implemented at Maine

Medical Center in Portland, Me, with financial support from Partnerships for Quality Education (PQE), an initiative of the Robert Wood Johnson Foundation. Maine Medical Center was one of nine primary care residency programs across the country to receive PQE grant funding to improve chronic illness care training. In a manner consistent with the CCM, the Chronic Care Collaborative integrates changes in care processes with residency training for effective care for patients with asthma. The collaborative program was implemented in the residency continuity clinics for pediatrics, internal medicine, and family practice between July 2002 and December 2003. Although there was variation in the content of the program across the three residency programs and their associated continuity clinics, common elements of the intervention related to five principal components of the CCM: community resources and policies, self-management support, decision support, delivery system design, and clinical information systems. The sixth component, promoting a culture of quality improvement throughout the organization, was not within the purview of the residency training program to address. Table 1 presents the program elements, distinguished by their emphasis on organizational change or education.

Fifty-nine residents participated in the key features of the training: 13 in pediatrics, 17 in family practice, 27 in medicine, and 2 in medicine/pediatrics. The most intensive of the training activities centered on chart review and quality-improvement projects. Chart reviews, undertaken by residents in all three programs, were designed to further

their understanding of the evidence underlying the asthma guidelines, develop their abilities to identify strengths and weaknesses within the clinic systems, and sharpen their analyses of the underlying sources of problems and potential strategies for improvement. Use of patient registries engaged residents in undertaking asthma-related quality-improvement projects and monitoring panels of patients over time. Trainees concurrently participated in a learning curriculum of 12 one-hour didactic sessions.\* Residency activities were supported by faculty development seminars for physicians and nurses in each department; a common element of these sessions across the three departments was an emphasis on application of the CCM to teach systems-based practice and practice-based learning and improvement, two of the new competencies set forth by the Accreditation Council for Graduate Medical Education.

## Method

We conducted a pre- and postintervention assessment of the initial year of the Chronic Care Collaborative asthma training program (July 2002 to June 2003). We examined outcomes for both residents and patients. For the residents, we measured the extent of change from the pre- to postintervention period in self-reported access to and implementation of elements of the CCM. For patients, we assessed the degree to which the intervention influenced

\*The curriculum is available on request by e-mail from Dr. Rogers (rogerv@mmc.org).

asthma-related ED use. The study was exempted by the IRB at Maine Medical Center.

### Resident assessment

Residents were assessed before and after exposure to the Chronic Care Collaborative training program. We designed the survey instrument to evaluate the degree to which residents had access to elements of the CCM in their continuity clinic as well as the extent to which their patients received care consistent with the CCM. Two of us (JG and MJY) developed an initial set of items corresponding to the five primary CCM components. Before administering the survey, the items were reviewed first for face validity by academic clinicians from the nine PQE-supported CCM training

initiatives across the country. Second, the items were pilot-tested with senior residents at Maine Medical Center to ascertain that the items were properly understood.

The final survey included questions that asked residents how easy or difficult it was at their continuity clinic to perform the following types of CCM tasks: access information on asthma-related community programs, consult asthma guidelines, and get a report on asthma patients who had not been recently seen. A second set of questions asked residents to report how many of their continuity clinic patients with asthma received or had access to the following: regular calls at home for asthma management, a written asthma management plan, and

enrollment in a self-management course or support group. Residents used four-point scales to respond to both sets of questions, ranging from "very easy" to "very difficult" for the first set of questions; for questions on what portion of their patients received specific services, the answers ranged from "all" patients to "none." The 12 items used in this study are specified in Table 2.

Residents completed the self-administered survey in the summer of 2002, just before program implementation, and again one year later.

Because all residents in Maine Medical Center's three primary care continuity clinic participated in the Chronic Care Collaborative, we employed a composite

Table 2

### Resident-Reported Access to and Implementation of the Chronic Care Model Elements Before and After Trainee Intervention, Maine Medical Center, Portland, Maine, 2002–2003

Chronic care model elements in continuity clinic	Percentage reporting favorable response			
	Intervention group (n = 41)		Comparison group (n = 77)	
	Pre	Post	Pre	Post
<b>Community resources and policies</b>				
Access detailed information on asthma-related community programs ("very" or "somewhat" easy)	27.5	51.2	26.0	27.3*
Enroll patients in a self-management course or support group ("all" or "most" patients)	0.0	7.5	5.8	11.8
<b>Self-management support</b>				
Patients' self-care or self-monitoring techniques routinely observed and assessed ("all" or "most" patients)	2.5	17.1	7.8	11.8
Patients receive individualized, written management plans ("all" or "most" patients)	26.8	56.1	11.8	17.3*
<b>Decision support</b>				
Consult guidelines for diagnosis and treatment of asthma before or during a patient visit ("very" or "somewhat" easy)	61.0	95.1	61.0	70.1*
Patients are called by the clinic regularly to monitor their home asthma management ("all" or "most" patients)	0.0	5.0	5.8	7.4
<b>Clinical information systems</b>				
Get a report identifying your patients with asthma who have not been seen for a well visit in the past six months ("very" or "somewhat" easy)	19.5	36.6	20.3	23.2
Have access to a patient's medical record during a telephone consultation ("very" or "somewhat" easy)	75.6	85.4	62.3	75.3
Get a report, based on medical records, indicating your or your team's performance in adhering to asthma guidelines ("very" or "somewhat" easy)	15.8	30.8	14.5	19.1
<b>Delivery system design</b>				
Discuss with a medical specialist a complicated patient for whom usual treatment options have been exhausted ("very" or "somewhat" easy)	53.7	75.6	62.3	70.1
Get timely input from a pharmacist on a complex medication regimen that is associated with debilitating side effects ("very" or "somewhat" easy)	46.3	58.5	63.6	57.1†
Have someone advocate for a patient to overcome a barrier to access, like insurance or transportation ("very" or "somewhat" easy)	56.1	65.9	37.7	52.2

\*  $P < .05$ .

†  $P < .10$ .

comparison group of trainees from the eight other PQE-supported CCM training programs across the country.<sup>†</sup> These 77 primary care residents were drawn from training programs that were similar to the intervention programs except that they had no major emphasis on CCM. Intervention residents at Maine Medical Center were similar to comparison residents with regard to age, gender, and year of training. On average, intervention and comparison group residents were 30 years old, slightly more than half were female, and most were in the first or second year of residency. Analysis of baseline intervention and comparison residents' responses indicate comparable access to and implementation of the CCM elements.

To assess the impact of the training intervention on residents' access to and implementation of the CCM, we compared the change from pre- to posttest for the intervention and comparison groups on each item using independent-samples *t* tests. For these analyses we dichotomized the four-point scales to contrast positive and negative responses.

### Patient assessment

We also examined the impact of the asthma training program on asthma patients' use of the ED for treatment and the associated cost. We assessed patients who received care at the residents' continuity clinics before and after implementation of the program. We compared the intervention patients' patterns of ED use with those of all other patients seeking care for asthma at Maine Medical Center, to minimize the possibility that observed changes in the intervention group were caused by factors other than the CCM intervention.

Inclusion in the intervention patient group required treatment for asthma in the 12 months before baseline and continued use (at least one visit) of the continuity clinic in the intervention

year (July 1, 2002, to June 30, 2003). Identification of patients with asthma in the pediatric and internal medicine continuity clinic was based on two factors: having asthma listed in the medical chart's problem list and having albuterol listed in the chart's medication list. For pediatric patients, we required that children be at least two years old at the start of the study for inclusion. The third continuity clinic (family medicine) did not have an electronic medical records system at the time of the study, so asthma patients were identified if there were two or more billing claims for asthma visits in the 12 months before baseline.

A total of 441 intervention patients met these criteria and were included in the study; 257 (58%) were adults. As was expected, the continuity clinic intervention patients were largely low income. The overwhelming majority of children (160, or 87%) and a substantial minority of adults (100, or 39%) had Medicaid coverage.

Because all continuity clinic patients were exposed to the intervention, we compare their ED use patterns with the patterns for all other Maine Medical Center patients. The comparison group as a whole had a higher socioeconomic status than the intervention group. For example, 35% of comparison pediatric patients had Medicaid coverage compared with 87% of children in the intervention group. Over the study time period there was little shift in hospital choice for asthma care, minimizing the possibility that the comparison population changed in size. Similarly, our examination of available epidemiological data yielded no evidence of significant changes in the prevalence of asthma in Maine between 2002 and 2003.<sup>12</sup>

We used hospital billing data to identify the number of asthma-related ED visits for intervention patients in the baseline year (July 2001 to June 2002) and the year of implementation (July 2002 to June 2003). ED visits were identified as being asthma related if the ICD-9 code started with 493. We also used the hospital billing data to determine the total amount billed for asthma-related care for intervention patients in the continuity clinic, the ED, and hospital during the baseline and implementation years, to assess whether there were any savings associated with the program.

## Results

### Residents

Forty-one of the 59 participating residents completed both pre- and postintervention surveys, yielding a response rate of 69%. At pretest, residents in both the intervention and comparison groups reported sporadic access to and implementation of the CCM (Table 2). Slight majorities reported that it was easy to access patient medical records during phone consultations, to get input from specialists and pharmacists, and to consult asthma guidelines before or during a patient visit. However, fewer than one in five reported that all or most of their patients had their self-care technique routinely observed and assessed, received telephone calls for home management monitoring, or received a written asthma management plan.

Maine Medical Center residents reported experiencing significantly greater increases in access to and implementation of the CCM than the comparison group for 4 of the 12 items measured. The intervention group improved more than the comparison group for six additional items, but the differences were of marginal statistical significance. The intervention was most effective at increasing access to information. Specifically, the greatest increases were observed in residents' access to asthma guidelines, the proportion of patients receiving written asthma management plans, and residents' access to information on asthma programs in the community. The magnitude of change for these items was quite large. For example, 95% of residents (39 out of 41) in the intervention group at posttest reported it was "very" or "somewhat" easy to consult asthma guidelines while seeing a patient, an increase of 34% from the baseline level. The Chronic Care Collaborative was far less successful in improving CCM items that required development of new programs (e.g., self-management support) or more staffing (e.g., making telephone home management calls and advocating for patients on social issues).

### Patient ED utilization

Not only did residents report improved adherence to the CCM over the course of the Chronic Care Collaborative, but

<sup>†</sup>PQE-supported CCM training programs at the following institutions: Access Community Health Network, Chicago, Ill; Albuquerque VA/University of New Mexico, Albuquerque, NM; University of California, Davis, Sacramento, Calif; Duke University Medical Center, Durham, NC; Albert Einstein Healthcare Network, Philadelphia, Pa; University of California, San Francisco, San Francisco, Calif; University of Virginia Health System, Charlottesville, Va; and University of Washington, Seattle, Wash.

Table 3

**Comparison of Asthma-Related Emergency Department (ED) Visits Between Intervention Patients and Other Hospital Users in a Chronic Care Improvement Study in the Baseline and Intervention Years, Maine Medical Center, Portland, Maine, 2002–2003**

Visit type	Continuity clinic asthma patients* (intervention)			All other Maine Medical Center patients (comparison)		
	Baseline (7/2001–6/2002)	Intervention (7/2002–6/2003)	% change	Baseline (7/2001–6/2002)	Intervention (7/2002–6/2003)	% change
<b>Pediatric ED visits</b>						
Asthma related	26	15	–42.3	250	271	8.4 <sup>†</sup>
Total	193	156	–19.2	12,869	13,079	1.6 <sup>‡</sup>
<b>Adult ED visits</b>						
Asthma related	64	36	–43.8	631	613	–2.9 <sup>‡</sup>
Total	567	404	–28.7	49,601	50,590	2.0 <sup>‡</sup>

\* There were 184 pediatric patients and 257 adult patients in the intervention group.

<sup>†</sup>  $P < .10$ .

<sup>‡</sup>  $P < .05$ .

changes in clinical care were associated with a reduction in asthma-related ED use for continuity clinic patients (Table 3). At baseline, 12% (22 of 184) and 16% (41 of 257) pediatric and adult intervention patients, respectively, sought ED care for asthma. The number of pediatric asthma-related ED visits dropped from 26 in the baseline year to 15 in the year the program was implemented, a decrease of 42%. A reduction of a similar magnitude (a drop of 44% from 64 to 36 visits) was observed for adult continuity clinic patients with asthma. Consequently, asthma ED visits constituted a smaller percentage of all ED visits for continuity patients in the implementation year compared with baseline (10% versus 14% for children and 9% versus 11% for adults).

Whereas the continuity clinic asthma patients decreased asthma-related ED use, we saw no similar reduction in asthma-related ED use overall at the hospital. Over the same time period there was a slight increase in asthma ED use for all other pediatric patients (from 250 to 271, or 8%) and a very small decrease for adults (from 631 to 613, or –3%).

#### Financial impact

We examined the financial impact of reducing asthma ED use among continuity clinic patients with asthma over the study period. Table 4 shows that the reductions in visits to the ED of 42% and 44% for pediatric and adult asthma patients, respectively, translates to reductions in billed charges of 48% (from

\$9,293 to \$4,823) and 36% (from \$22,890 to \$14,442). It seems that the program also had a positive impact on reducing hospitalization charges, which dropped even more substantially. Notably, clinic-related asthma charges increased for adult patients and dropped, but by a comparatively small amount, for pediatric patients. In sum, we estimate that there were net savings of approximately \$46,000 in billed care as a result of the Chronic Care Collaborative training program.

#### Discussion

As caring for chronic illness becomes an increasingly large share of primary

care, it is essential to train primary care physicians to provide effective chronic illness care. Our findings raise concern about how well residents are currently being trained to treat chronic illness. Before the intervention, few residents in this study reported having the ability to use information systems either for tracking their clinical performance or for their patients' health care use. Similarly, only a small minority reported that their continuity clinic patients received the self-management support or the home monitoring support that is considered essential for patient control of chronic illness. This was true not only for Maine Medical Center residents before the

Table 4

**Asthma-Related Emergency Department Billing Charges for Intervention Patients in a Chronic Care Improvement Study in the Baseline and Intervention Years, Maine Medical Center, Portland, Maine, 2002–2003**

Billing charge	Baseline (7/2001–/2002)	Intervention (7/2002–6/2003)	% change
<b>Pediatric asthma charges</b>			
Clinic*	\$15,052	\$13,635	–9
Emergency room	\$9,293	\$4,823	–48
Hospitalizations	\$20,161	\$5,286	–74
Total	\$44,506	\$23,744	–47
<b>Adult asthma charges</b>			
Clinic*	\$12,295	\$16,096	31
Emergency room	\$22,890	\$14,548	–36
Hospitalizations	\$35,040	\$14,442	–59
Total	\$70,225	\$45,086	–36

\* Clinic billing was not ascertained for family practice patients, which excludes 14% of the asthma continuity patients.

Chronic Care Collaborative training program but also for the comparison residents who were from eight primary care residency programs across the country.

However, our findings are also cause for optimism regarding the impact of primary care residency training in treating chronic illness. The Chronic Care Collaborative training program achieved measurable improvements in several elements of the CCM, mostly associated with information provision and availability. We observed, for example, substantial increases in the reported accessibility of asthma guidelines for residents and the proportion of patients receiving individualized, written asthma management plans. The program was less successful in making improvements that required investments in technology, increases in clinical staffing, or development of new programs. This suggests that to be more effective, training should be conducted in settings that have in place the resources and technology central to implementation of the CCM.

Our findings not only indicate that the Chronic Care Collaborative training program positively influenced the clinical care patients received, but suggest that it improved the health outcomes of the patients treated by the residents in the continuity clinics. Intervention patients reduced their asthma-related ED visits by approximately 43% the year the training program was implemented compared with the prior year. This, in turn, resulted in about 40% lower asthma-related medical charges. The intervention also seems to have reduced non-asthma-related ED visits for both children and adults, suggesting a spillover effect beyond the care of asthma. It is noteworthy that the clinic population under study was predominantly low income and covered by Medicaid. Given that they were of lower socioeconomic status than the comparison group, the observed differences in outcomes may be understated. Thus, the training program catalyzed reductions in ED use among a patient population considered by many physicians less compliant and harder to treat than the privately insured.<sup>13,14</sup> We conducted similar analyses for asthma-related hospitalization (unreported because of the

understandably small numbers of hospitalizations) and found similar patterns of reductions in use and associated decreases in charges.

It is notable that the program's savings largely benefited the Medicaid program, which is publicly funded. The hospital, in contrast, lost asthma-related revenue as a result, though the program eased the overcrowding that is endemic to EDs nationwide<sup>15</sup> and may have diminished the volume of uncompensated care. For broader implementation of the CCM, there may need for a realignment of incentives so that the cost savings will accrue to medical centers with improved patient care.

This study's findings should be interpreted in light of several limitations. With regard to the resident assessment, our sample size was limited by the relatively small number of residents trained at Maine Medical Center. Our nonrandom comparison group was a composite of primary care residents from eight programs across the country and may have differed in systematic ways from the intervention residents, though sociodemographics and baseline measures were similar. Finally, for the resident-related variables, we relied on self-report, which may differ from actual experience.

Analyses of patient data were limited by several factors. Although we had a sizable number of intervention patients, ED visits are a relatively infrequent event and hospitalizations are even rarer. Consequently, the number of ED visits in the intervention group was relatively small, and the number of hospitalizations was too small for statistical testing. We were also limited by the nature of the comparison group, which was made up of all other Maine Medical Center patients. Although we believe there was no change in hospital market share or prevalence in asthma that might have influenced their asthma-related ED use, it is possible that the composition of this group differed in important but unanticipated ways. We did rule out the possibility that changes in Medicaid ED copayments during the study period might have influenced our findings; there were no changes.

In sum, this study confirms that primary care residency programs incorporating a chronic care training program can

influence the health outcomes of patients treated in their continuity clinics. Whereas the CCM is a very broad, multifaceted model, this study indicates that improvements may be effective even when they are not costly or comprehensive.

## Acknowledgments

This study was undertaken as part of the evaluation of Partnerships for Quality Education (PQE) funded by The Robert Wood Johnson Foundation (grant #036808). The authors would like to acknowledge the hard work of The Chronic Care Collaborative at Maine Medical Center with special thanks to the following individuals: Jacquelyn Cawley, DO; Barbara Chiltonczyk, MD; Lisa Letourneau, MD, MPH; Jane Pringle, MD; Susan Swartz, MD, MPH; Deborah Deatrack, MPH; Pam Lajeunesse, NP; Mary McDonough, RN; Patricia Roderick, RN, MEd; Danielle Earle; and Deana Voudrie. The authors also thank the PQE national program office for their interest in the evaluation, the eight other PQE-supported chronic illness training programs for enabling the development of a comparison group of trainees for this assessment, and Peter Chingos at Maine Medical Center for technical support.

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## Correction

In the article by Hamdy and Anderson in the December issue,<sup>1</sup> there was an error in the first sentence of the abstract. Here is the correct first sentence:

In the late 1970s, leaders of the Arabian Gulf countries proposed a novel idea of a joint educational and cultural venture: establishing a new regional university based in the Kingdom of Bahrain that would be managed as a multinational consortium of Gulf countries including Saudi Arabia, United Arab Emirates, Kuwait, Oman, Qatar, and Bahrain.

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Hamdy H, Anderson MB. The Arabian Gulf University College of Medicine and Medical Sciences: a successful model of a multinational medical school. *Acad Med.* 2006;81:1085–1090.

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