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Reducing Cardiovascular Risk for Patients With Diabetes: An Evidence-Based, Population Health Management Program

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ABSTRACT

Those with diabetes are at an increased risk of cardiovascular disease (CVD). Safety net clinics serve populations that bear a significant burden of disease and disparities and are a key setting in which to focus on reducing CVD. An integrated health system provided funding and technical assistance (TA) to safety net organizations (community health centers and public hospitals) in Northern California to decrease the risk of cardiovascular events for patients with diabetes. This was a program called Preventing Heart Attacks and Strokes Everyday (PHASE), which combined an evidence-based medication protocol with population health management and team-based care strategies. The TA supported organizations by sharing best practices, providing quality improvement coaching, and facilitating peer learning. A mixed-methods evaluation found that organizations involved in PHASE improved rates of blood pressure control and cardioprotective medication prescriptions for patients with diabetes. They made progress on these measures through strategies such as leveraging team-based care, providing education on evidence-based protocols, and using data to drive improvements. The evaluation concluded that financially supporting and providing focused TA to safety net organizations can help them build capacity and leverage their strengths to improve outcomes and potentially decrease the risk of heart attacks and strokes in communities.

Keywords: cardiovascular disease, diabetes, community health centers, evidence-based medicine

Introduction

Cardiovascular disease (CVD) is a leading cause of death in the United States.[1] Those with diabetes are at an increased risk of CVD and other cardiovascular events.[2] There are myriad ways to address cardiovascular risk reduction in primary care,[3-5] including medication to improve blood pressure (BP) control and cholesterol levels and supporting patients in lifestyle management.[6,7]

Cardiovascular disease risk is complicated by racial, lingual, socioeconomic, and immigration-status disparities.[8-13] Safety net clinics (community health centers and public hospitals) serve populations that bear a significant burden of these disparities[14-16] and, thus, are a key setting in which to reducing disparities in CVD. Decreasing CVD risk in these settings could contribute to achieving national goals (such as healthy people and million hearts)[17,18] as well as reductions in disparities.

This article describes a large-scale initiative in the Northern California safety net that aimed to improve specific clinical quality measures related to CVD risk through funding and technical assistance (TA) delivered through a learning collaborative. We investigated the strategies and TA that contributed to achievements in relevant measures.

An integrated health system in Northern California designed the Preventing Heart Attacks and Strokes Everyday (PHASE) program to reduce heart attacks and strokes for those at high risk for CVD. It began in 2004 as an internal program for the health system's patients with diabetes and/or CVD. Their evidence-based clinical protocol ("PHASE-on-a-Page") was shown to reduce heart attacks and strokes by more than 60% among members.[19] A population-based

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program was also implemented for individuals with hypertension, showing better improvement in BP control rates compared with Californian and national rates.[20] The integrated health system then shared the programs with community health centers and public hospitals beginning in 2007.[21,22] This community implementation included grant funding and technical consultative support. From 2007 to 2016, the program expanded to include a formal learning community and a structured quality improvement component. This article describes results of the subsequent safety net grant-funded program cycle from 2017 to 2019.

The community benefit program of the integrated health system supported the PHASE program in the safety net by providing TA and grant support to 18 organizations ("grantees") across 17 counties in Northern California from January 2017 to December 2019. The grants ranged from $50,000 to $167,000 annually depending on the organization size and type. The TA, funded at $1,500,000 for 3 years, included quarterly webinars, biannual in-person convenings, individual quality improvement coaching, and clinical resources from the health system's medical group. The TA objectives were informed by the literature on high-performing primary care and aimed to support implementation of evidence-based clinical best practices through effective population management, data-informed decision-making, quality improvement, and team-based care.[23] Webinars and convenings showcased experts in these fields and in cardiovascular risk management, evidence-based practice, health coaching, and motivational interviewing. All TA included peer sharing to share best practices across sites to help identify potential solutions and implement them within the context of PHASE. No CME credits were offered.

Methods

The mixed-methods evaluation aimed to answer the following questions: (1) to what extent did sites improve performance on clinical quality measures for patients with diabetes, including population BP control rates, prescription of statins, and prescription of angiotensin-converting enzyme inhibitors (ACEs) or angiotensin receptor blockers (ARBs); (2) what strategies did grantees use to make progress on these measures? Methods included site-level quantitative clinical quality data, semistructured interviews, and surveys of team members from each grantee.

The 18 grantees comprised five public hospitals (submitting clinical quality data for 32 clinic sites), four regional clinic consortia (submitting clinical quality data for 30 health center organizations, hereafter referred to as sites), and nine community health centers (submitting clinical quality data for 49 clinic sites). Each site submitted clinical quality data quarterly from the previous 12 months. Data span from Q1 2017 (April 1, 2016, to March 31, 2017) to Q4 2019 (January 1, 2019, to December 31, 2019). Site-level data were submitted to the evaluation team by a standardized spreadsheet, with no individual patient-level data shared. Grantees used their own internal data reporting tools to collect the clinical outcomes of interest: BP control rate and rates of prescription of ACE/ARBs and of statins (see Table 1 for definitions). The evaluation team had quarterly calls with grantees about data quality, leading to exclusion of some data before statistical analysis; the remaining data were deemed of sufficient quality by the submitting organizations. Changes over time in these measures were examined with linear regression with cluster robust standard errors by site to account for correlation of observations within sites and weighted by the number of patients with diabetes at each site for each time period.

Semistructured quarterly interviews with the 18 grantees were conducted to understand data quality and implementation strategies. Between two and five team members participated in each interview, including team leads and relevant clinical, quality improvement, and data analytic staff. The interview protocol was standardized across quarters. Quarterly interview transcripts were coded using Atlas.ti 8.0. Codes were identified a priori based on the program's evaluation plan and the interview protocol. Two evaluators coded the interview transcripts, and ensured codes were applied consistently. Codes were pulled, and coding memos were developed to highlight key themes.

Surveys were administered twice during the study period (July 2018 and December 2019) to two team members from each of the 18 grantees. Survey recipients were chosen because of their program participation and knowledge of organizational processes. The 15 survey questions were derived from strategies identified during quarterly interviews. Twelve questions were close-ended to understand what specific strategies grantees were using to address CVD risk and to assess satisfaction with and impact of the TA provided using Likert scales. There were three open-ended questions to allow for respondents to explain their responses and to provide programmatic feedback. The response rates for the 2 surveys were 69.4% and 75.0%. Descriptive statistics were conducted in Excel.

Our institution's institutional review board determined that this project did not qualify as human subject research and was exempt from review.

Table 1. Clinical Quality Measure Definitions

	Numerator	Denominator
Blood pressure control for those with diabetes ages 18–75	# of patients with diabetes aged 18–75 who have a blood pressure of <140/90 mm Hg at the most recent visit during the past measurement year	Patients aged 18–75 with at least two outpatient visits, observation visits, emergency department visits, or nonacute inpatient on different dates of service, with a diagnosis of diabetes during the measurement year or year prior OR with at least one acute inpatient encounter with a diagnosis of diabetes during the measurement year or year prior. Optional exclusion: patients who had a diagnosis of gestational diabetes or steroid-induced diabetes, in any setting, during the measurement year or the year before the measurement year.
Prescription of ACE/ARB for those with diabetes aged 55–75	# of patients with diabetes aged 55–75 who have been prescribed an ACE or ARB, where the medication order is current at some point during the measurement year	# of patients aged 55–75 with at least two outpatient visits, observation visits, emergency department visits, or nonacute inpatient on different dates of service, with a diagnosis of diabetes during the measurement year or year prior OR with at least one acute inpatient encounter with a diagnosis of diabetes during the measurement year or year prior. Optional exclusion: patients who had a diagnosis of gestational diabetes or steroid-induced diabetes, in any setting, during the measurement year or the year before the measurement year.
Prescription of statin for those with diabetes aged 55–75	# of patients with diabetes aged 55–75 who have been prescribed a statin, where the medication order is current at some point during the measurement year	# of patients aged 55–75 with at least two outpatient visits, observation visits, emergency department visits, or nonacute inpatient on different dates of service, with a diagnosis of diabetes during the measurement year or year prior OR with at least one acute inpatient encounter with a diagnosis of diabetes during the measurement year or year prior Optional exclusion: patients who had a diagnosis of gestational diabetes or steroid-induced diabetes, in any setting, during the measurement year or the year before the measurement year.

ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker.

Results

Clinical Metrics

The number of sites reporting data each quarter generally increased over time as organizations spread the PHASE program to additional sites within their organization (Table 2). From interviews, we learned that fluctuation in reporting was due to data not being reliable over time and thus excluded or inconsistencies across sites' electronic health record or data analytics tools rendering past data inconsistent. The average number of individuals with diabetes at the 111 sites over the 12 quarters of data ranged from less than 20 to almost 7,000.

Analysis of the quarterly clinical data indicated statistically significant improvements in 2 of the 3

Table 2. Number of Sites Reporting Data by the Measurement Period and Variable for Clinical Quality Measures

Measurement period	Number of sites submitting data for blood pressure control for those with diabetes	Number of sites submitting data for prescription measures
April 1, 2016, to March 31, 2017	45	27
July 1, 2016, to June 30, 2017	48	47
October 1, 2016, to September 30, 2017	47	48
January 1, 2017, to December 31, 2017	57	56
April 1, 2017, to March 31, 2018	78	82
July 1, 2017, to June 30, 2018	86	86
October 1, 2017, to September 30, 2018	100	100
January 1, 2018, to December 31, 2018	102	102
April 1, 2018, to March 31, 2019	99	87
July 1, 2018, to June 30, 2019	100	88
October 1, 2018, to September 30, 2019	101	87
January 1, 2019, to December 31, 2019	106	86

biometrics tracked during 2017–2019 (Table 3). Specifically, rates of BP control increased by 0.35% per quarter on average. The rate of statin prescription increased by 0.41% per quarter on average. The trend in the rate of ACE/ARB prescription was statistically insignificant. Although outliers exist in the data, removing outliers did not meaningfully change results (data not shown).

The mean of sites' rates shifted over time for each measure in the upward direction (Figure 1). The mean rate of BP control at the start of the grant was 72.1%, and by the end of the grant, it was 76.9% (one-sided paired t test; p-value 0.053). For the prescription of statins, the mean increased from 73.1% to 77.2%, which was statistically significant (one-sided paired t test; p-value $<$ .001). The rate of prescriptions of ACE/ARB increased from 69.3% to 75.2% by the end of the grant (one-sided paired t test; p-value 0.054). Individual sites' change over time for BP control ranged from −21.9% to 20.4%; 64 sites improved, and 40 sites decreased. For prescription of statins, the change over time ranged from −15.1% to 25%; 78 sites improved, and 26 sites decreased. The range of change over time for prescription of ACE/ARB was from −12.4% to 47.8%; 59 sites improved, and 45 sites decreased.

Implementation Strategies for Evidence-Based Medication Protocol

Data from interviews and surveys indicated that each site implemented the evidence-based medication

Table 3. Regression Results

Source: quarterly clinical data reports from the 18-funded organizations (see Table 2 for the number of observations).

	% BP control	Prescription of ACE/ARB (%)	Prescription of statin (%)
Beta (SE)	0.35% (0.11%)	0.06% (0.11%)	0.41% (0.10%)
Intercept (std error)	72.8% (1.6%)	72.5% (1.2%)	74.3% (1.1%)
	$p < .001$	$p > .5$	$p < .001$

protocol, PHASE-on-a-Page,[24] based on their site's operations, workflows, and medication formularies. The most common strategies identified for implementing the medication protocol were instituting provider education on medication guidelines and using a PHASE champion to support their efforts to implement the protocol (see Table 4). The next most common strategies were providing medication adherence support to patients and using health information technology to support the use of medication protocols.

Educating providers on clinical guidelines, including PHASE-on-a-Page, was a key strategy for sites. The education was to increase understanding of, and overcome provider resistance to, an algorithmic approach to medication management while allowing for patient-specific deviations from protocol as needed. Grantees identified key accomplishments, such as their organization formally approving and adopting the protocol, converting providers who were initially resistant into clinical champions, and implementing the protocol through alternative visits with nurses or pharmacists for medication titration.

Most grantees reported that using a PHASE champion to support implementation efforts was critical to their success. Across grantees, different types of staff served as the PHASE champion. For hospitals and health centers, the champions were often clinical staff (e.g., physician, physician assistant, or nurse practitioner). For consortia, the champion was typically a medical director or the quality improvement leader. The PHASE champions played an important role in supporting implementation and underscored the importance of clinical leadership to motivate providers.

Implementation Strategies for Improving Blood Pressure Control Rates

All 18 grantees implemented multiple strategies to achieve their goals for improving BP control. On average, organizations adapted seven care processes to support their efforts to improve BP control. The most common processes included the following: building leadership and staff commitment to improving BP control; training, assessing, and auditing-specific staff skills (e.g., medical assistants taking repeat BP measurements when the first measurement is high); and training staff in motivational interviewing and/or health coaching to support patients in their self-management (Table 5).

Differentiating High Performers in Blood Pressure Control

Some high performers established nurse or pharmacist BP visits using standing orders and shared provider-level data to drive improvement. In addition, high-performing sites emphasized the importance of establishing standard workflows for proactive population management to conduct inreach and outreach to patients at risk for CVD. Sites that were high performers or made significant improvements had stronger practices and infrastructure established in the building blocks of quality improvement and data-based decision-making. Most high performers used data infrastructure to pull relevant data (e.g., BP recheck data by a medical assistant), shared data transparently (e.g., posting identified site-level and provider-level data on walls), and maintained a close connection between quality improvement and clinical teams to ensure data accuracy.

For sites that were lower performing or saw declines, they often reported challenges in one or more of the "building blocks." They were more likely to have challenges with their ability to collect and report accurate data, which limited its usefulness for driving internal improvement efforts. Sites with poorer outcomes more frequently reported inability to make process changes because of low team engagement or high turnover, providers who were resistant to population management approaches, or leaders who did not empower or provide time to teams to make improvements.

Sustainability

Grantees described the infrastructure, capacity, and practices needed to make improvements in BP control and prescribing practices. This included the importance of buy-in from organizational leaders, leveraging members of a multidisciplinary care team, and accurate patient empanelment and registries to identify patients. Grantees reported that infrastructure built in PHASE supported sustainability beyond the grant: implementing, documenting, and updating workflows to improve care and reduce impact of turnover, aligning PHASE work with other organizational priorities such as deepening quality improvement culture or whole person care programs, and engaging organizational leaders early-on in projects to ensure buy-in. These processes also supported spreading PHASE to additional sites within an organization.

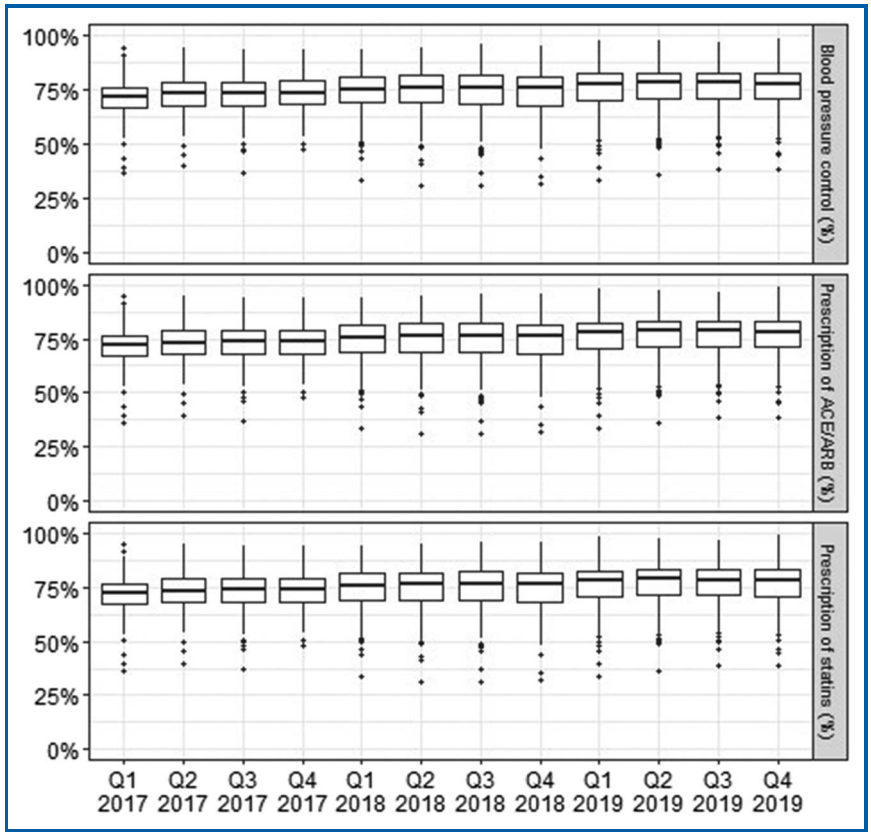

Figure 1. Clinical data over time.

Role of Preventing Heart Attacks and Strokes Everyday Technical Assistance

A consistent theme from interviews and surveys was the importance of learning from other sites doing similar work to accelerate progress. Although subject matter expert webinars were seen as useful, peer-learning opportunities—such as in-person convenings, visiting high-performing sites, and structured virtual sharing—were viewed as most useful. As one leader said,

> *"Seeing what other clinics are doing and being able to learn from them is one of the most valuable things we gained from participating in PHASE."*

As a result of PHASE, all grantee team leads reported increased confidence in their ability to support their organization in data-based decision-making, population health management, and team-based care.

Limitations

This evaluation examined the prescription rates of ACE/ARBs and statins for individuals with diabetes. Although there are other medications that could be prescribed to manage CVD risk, these medications were chosen to assess implementation of the evidence-based PHASE-on-a-Page medication algorithm.[24] Sites were unable to report prescription rates for those for whom the drugs were indicated. To approximate the population for whom ACE/ARBs and statins were indicated, the prescription rate denominators capture patients with diabetes ages 55–75 because statin and ACE/ARB are often recommended for those patients.[25]

The clinical quality data provided by grantees were not independently certified. We discussed data quality concerns with the grantees during interviews and excluded clinical quality data which we knew to be inaccurate to mitigate this concern. Demographic data about individuals served by PHASE sites were not collected and so could not be included as covariates in regressions.

Discussion

The results show that grantees improved about 1.4% annually based on the quarterly rate of change for BP

Table 4. Most Common Strategies to Improve Prescription Rates of Cardioprotective Medications
Source: two surveys of 18 funded organizations; if an organization used the strategy at either of the two time points, they are included in the *n*
Used a PHASE champion to support efforts to implement the protocol ($n = 18$)
Instituted provider education on guidelines, medication protocol, and/or PHASE on a page ($n = 17$)
Used health IT (e.g., EHR and/or population management system) and other tools such as alerts, order sets, or standing orders to help ensure PHASE on a page protocol is followed ($n = 15$)
Provided medication adherence support to patients ($n = 15$)
Adapted PHASE on a page specifically for organization's use ($n = 11$)
Reviewed/shared data on prescription rates by provider to drive provider behavior change ($n = 9$)
PHASE, Preventing Heart Attacks and Strokes Everyday.

control for those with diabetes. To contextualize these results, we looked at national data from a similar timeframe. We found the BP control rates for individuals whose care was delivered in the health systems implementing PHASE were higher than Healthy People 2020 achievements, which provided evidenced-based resources but not a formal program of improvement.[26] In addition, 75% of PHASE sites achieved BP control of 70% or higher, compared with 47% of sites involved in Target: BP in 2019.[27] Target: BP is a joint initiative between the American Medical and American Heart Associations that similarly uses an evidence-based quality improvement program to improve BP control.[28] Differentiators between these programs and PHASE include PHASE's regional learning collaborative that supported grantees in finding and implementing solutions, the engagement of an integrated health system with safety net providers, and the length of that engagement, although this article highlights only 3 years of the initiative.

Prescribing medications has been shown to be an effective strategy to control BP.[15] Grantees successfully modified the integrated health system's processes to best fit their needs and resource constraints. For example, some modifications of the original

Table 5. Most common strategies to improve rates of BP control
Source: two surveys of 18 funded organizations; if an organization used the strategy at either of the two time points, they are included in the *n*
Generated EHR and health information technology reports to identify care gaps and drive action to close them ($n = 17$)
Trained and assessed staff on specific skills related to BP measurements ($n = 17$)
Trained staff in motivational interviewing and/or health coaching ($n = 17$)
Used patient engagement/education tools to help patients understand their condition ($n = 16$)
Used previsit planning tools informed by data to help care teams identify key actions for the visit ($n = 16$)
Implemented workflows for medical assistants to gather key data from patients for productive provider encounter ($n = 15$)
Used protocols to ensure that patients and staff follow-up after a visit as planned ($n = 15$)
Implemented protocols for staff to follow-up on BP and other key parameters updated between provider visits (e.g., by nurse-only visit or response to out-of-range patient home BP readings) ($n = 14$)
Created processes to proactively track and manage patients with hypertension (e.g., outreach, using a registry, nurse-only visits, and responses to out-of-range patient home BP readings) ($n = 14$)
BP, blood pressure.

medication protocol were necessary to align with Medicaid formularies as opposed to the integrated health system's formulary.[21] Preventing Heart Attacks and Strokes Everyday grantees implemented strategies to support their providers in medication management through provider education and medication titration visits with clinical pharmacists and nurses. These strategies align with literature that emphasizes involving clinical pharmacists in patients' treatment of chronic diseases,[29-32] nurses to titrate medications with standing orders from physicians,[33,34] and provider support for guideline adherence.[35] These structures will be in place beyond the funding from PHASE, supporting grantees to sustain and spread this work.

Sustainable clinical improvements typically require multifaceted approaches. We found that, in addition to prescribing the appropriate medications, grantees implemented several additional strategies to improve BP control in their patients. The strategies that sites used to improve BP control are similar to recommendations from similar programs, highlighting a standard set of strategies needed to advance population health.[3-5] The success factors and capacities built during PHASE align with literature of the systems and processes needed for high-performing primary care—specifically leadership support, using data for decision making, strong quality improvement infrastructure, leveraging multidisciplinary care teams, and proactive population management.[23]

Conclusions

Organizations that participated in the PHASE program improved their sites' rates of BP control and cardioprotective medication prescriptions for those with diabetes. They indicated that the PHASE program contributed to these positive outcomes by providing an evidence-based medication protocol, robust TA program that included expert consultation and peer learning, and multifaceted strategies implemented at their clinics to support population health management for patients at high risk of CVD.

Implications

For individual practices, the qualitative and survey components of the evaluation supported what the literature has shown works to improve population-based BP control, in this case, among a diverse set of safety net organizations that frequently serve the most underserved patients. Clinics used multifaceted strategies based on evidence-based guidelines, leveraged nonphysician members of their care team and relied on quality improvement and data infrastructure to monitor performance.

For health systems and other funders, this evaluation suggests that through targeted and evidence-based TA and grant funding, funders can support and improve cardiovascular-related outcomes in primary care settings. Technical assistance helped to connect sites to evidence-based guidelines and clinical expertise, strengthen and provide accountability around quality improvement and data practices to ensure sustainability, and provided access to peer learning. Funding provided focus and accountability to CVD risk-reduction efforts and allowed sites to dedicate funding to manage the work. Many grantees participating in the PHASE program have been funded since the program began in 2007, and they discussed the benefits of long-term funding to build sustainable organizational infrastructure.

By leveraging and strengthening existing capacities, safety net organizations are positioned to improve the population health of the communities that they serve, which tend to be communities who experience disparities in access, care, and outcomes. Although the focus on safety net providers was intended to help address community disparities in CVD-related outcomes, this evaluation was not able to study the direct impact on disparities, in part because of inconsistent availability of population-level data segmented by race/ethnicity and other demographic factors. In future research, it would be important to look at whether these changes improve care for all populations or whether targeted strategies may be needed to address disparities in CVD-related outcomes.

Authors' Biographies

Carly Levitz, MPH, is an Evaluation and Learning Associate at the Center for Community Health and Evaluation (CCHE) within the Kaiser Permanente Washington Health Research Institute. She has been evaluating safety net improvement programs for six years.

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Michael Cox, MS, recently retired after nearly 25 years with Kaiser Permanente Northern California. During that time, while working as one of the first Clinical Health Educators for Kaiser Permanente, he piloted group visits in hypertension and diabetes, as well as PHASE group visits. Later, in his career with Kaiser Permanente Northern California Community Benefit, he acted as grants manager for the PHASE Initiative.

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