Health Service Research

Relationship among team dynamics, care coordination and perception of safety culture in primary care

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Abstract

Background. There remains a need to improve patient safety in primary care settings. Studies have demonstrated that creating high-performing teams can improve patient safety and encourage a safety culture within hospital settings, but little is known about this relationship in primary care.

Objective. To examine how team dynamics relate to perceptions of safety culture in primary care and whether care coordination plays an intermediating role.

Research Design. This is a cross-sectional survey study with 63% response ($n = 1082$).

Subjects. The study participants were attending clinicians, resident physicians and other staff who interacted with patients from 19 primary care practices affiliated with Harvard Medical School.

Main Measures. Three domains corresponding with our main measures: team dynamics, care coordination and safety culture. All items were measured on a 5-point Likert scale. We used linear regression clustered by practice site to assess the relationship between team dynamics and perceptions of safety culture. We also performed a mediation analysis to determine the extent to which care coordination explains the relationship between perceptions of team dynamics and of safety culture.

Results. For every 1-point increase in overall team dynamics, there was a 0.76-point increase in perception of safety culture [95% confidence interval (CI) 0.70–0.82, $P < 0.001$]. Care coordination mediated the relationship between team dynamics and the perception of safety culture.

Conclusion. Our findings suggest there is a relationship between team dynamics, care coordination and perceptions of patient safety in a primary care setting. To make patients safer, we may need to pay more attention to how primary care providers work together to coordinate care.

Key words: Academic medicine, medical home, patient safety, primary care, quality of care.

Introduction

Major gaps exist in our knowledge of patient safety in primary care settings (1). Both the volume of care provided in primary care settings and complexity of patients cared for outside the hospital have grown, increasing opportunities for errors. Attention has thus turned

to patient safety in primary care settings where there remains a need to create safe, efficient, and sustainable systems (1).

Safety culture—'shared values, attitudes, and patterns of behavior regarding safety' (2)—is seen as critical for achieving patient safety gains. Tools designed to measure staff members' perceptions

of safety culture in inpatient settings have been adapted for primary care (2–5). A better understanding of the role of safety culture in primary care will allow interested parties to develop and test interventions to improve primary care patient safety (6). Prior studies find that creating high-performing teams is important for encouraging a culture of safety (7–9). Better safety climates, in turn, have been correlated with fewer medication errors, nursing back injuries, readmission rates after acute myocardial infarctions, serious safety events and an array of patient safety indicators (2,8,10).

Despite what is known from other industries and from inpatient settings about the importance of teamwork and safety culture, for example decreased error rates (7,9–11), few studies have looked specifically at the relationship between high-functioning teams and perceptions of safety culture in the primary care setting (6). More specifically, few studies consider how team dynamics within primary care practices that have established team-based care (which is a core element of patient-centred medical home initiatives) relate to safety culture.

A particular area of concern highlighted by prior primary care patient safety research has been care coordination both within the same team and across different teams, both of which are important for safety culture and patient safety (11–14). Care coordination within a team has the potential to mediate the relationship between team dynamics and perceived safety culture because many errors in the outpatient setting occur as a result of coordination problems: breakdowns in communication, failures to close referral loops and insufficient follow-up of abnormal tests (11–14).

In the current study, we are interested in understanding how team dynamics correlate with perceptions of safety culture and whether care coordination plays an intervening role. We conceptualize the relationships between team dynamics, care coordination and perceptions of patient safety as follows (Fig. 1). First, our model suggests that team dynamics—how the team is constituted and how it functions and performs—shape team members' perceptions of their organization's culture, specifically its safety culture. Thus, our first hypothesis is that ratings of overall team dynamics will relate positively to perceptions of safety culture (hypothesis 1). For example, we expect that leaders' support of teamwork and team development and the corresponding actions frontline staff take to enact teamwork (e.g. scheduling regular team meetings, regular huddles prior to patient visits) lead to changes in team member behaviours (e.g. more frequent communication and more thorough test follow-up) and work climate that contribute to a culture that staff report feels more open and safe (2).

Second, given our interest in the role of care coordination in the relationship between team dynamics and safety culture, we hypothesize that care coordination—specifically, the extent to which teams succeed at coordinating, such as by closing communication loops—mediates the positive relationship between team dynamics and

perceived safety culture (hypothesis 2). In other words, we expect that care coordination is a mechanism through which teams improve safety. We expect this because working in teams can enable members to better coordinate patient-related activities, and improved care coordination enables teams to accomplish their safety objectives. In this way, experiencing improved coordination in teams would improve team members' perceptions of safety culture. If so, care coordination would mediate between teamwork and perceived safety culture. Alternatively, it is possible that positive team dynamics merely result in better relationships and more positive affect among team members, without effect on coordination among members. Figure 1 also acknowledges the role of safety culture as a contextual factor shaping team dynamics in the context of teams working together to improve safety. We expect that any perceived improvement in safety culture in turn will also enable teams to function more successfully.

In this study, we evaluated the relationship between team dynamics and perceptions of safety culture among patient-facing providers (i.e. any primary care staff member with patient contact) and whether their perceptions of care coordination mediated this relationship.

Methods

Study design

We used a psychometrically validated instrument to conduct a cross-sectional study of 1716 practice personnel (i.e. attending clinicians, resident physicians and other patient-facing staff) who regularly interacted with patients in 2014 (15,16). One-fifth of staff were fully trained attending clinicians (primary care physicians, nurse practitioners and physician assistants) while 53% had other patient-facing staff roles (e.g. nurses, social workers, medical assistants and administrative personnel); 27% were resident physicians.

Setting

Our survey respondents worked within 19 practices that had established team-based care between 2012 and 2014 and were participating in the Harvard Academic Innovations Collaborative (AIC) initiative to promote Comprehensive, Accessible, Reliable, Exceptional and Safe (CARES) care from 2014 to 2016 (5). The goal of the learning collaborative was to improve patient safety, especially around breast and colorectal cancer screening and care of complex patients. All practice personnel were encouraged to participate in daily team huddles focused on improving information exchange about shared patients, monthly web-based meetings facilitated by practice change experts and quarterly in person meetings that involved curriculum focused on redesigning care processes. Most of the teams consisted of at least one attending clinician or resident physician and at least one of the other type of patient-facing staff such as a medical assistant, nurse and patient coordinator/front desk staff member. Some teams also included a social worker.

Survey domains

The survey included three key domains that mirrored goals of the AIC intervention: team dynamics, care coordination and perceptions of safety culture. Survey items in the domains of interest were all measured on a 5-point Likert scale (1 = strongly disagree, 3 = neither agree nor disagree, 5 = strongly agree). The survey was administered to staff via their work email addresses a total of three times between August and December 2014.

Figure 1. Conceptual model for the relationship between team dynamics, care coordination and perception of safety culture

The first part of the survey was a 29-item validated Primary Care Team Dynamics instrument, designed to assess team dynamics in ambulatory settings (15,16). Originally, this instrument included seven factors of primary care team dynamics: conditions for team effectiveness, shared understanding, processes for accountability, processes for communication and information exchange, processes for conflict resolution, acting and feeling like a team and perceived team effectiveness. The psychometric reliability and validity of this factor structure were demonstrated in the AIC population in previous administrations of the survey (15). We modified the previously validated team dynamics survey (15) by adding a new factor on learning processes so that the survey contained eight total domains related to team dynamics (Supplementary Material Survey Items). We also verified that these survey modifications did not adversely affect internal consistency (i.e. Cronbach's alphas remained in the appropriate range 0.71–0.91) or discriminant validity (Pearson correlations between factors were lower than their internal consistency).

The second part of the survey included a maximum of five items designed to assess care coordination (e.g. ease of knowing if critical tests were completed, there was follow-up on positive test results, whether a referral had been placed, what consulting physicians recommend for patients, and communication with specialists had occurred). All five care coordination questions were applicable to attending clinicians and residents; four (all but the last item) were applicable to other patient-facing staff. The Cronbach's alpha for each set of items was 0.79 for attending clinicians and residents, and 0.89 for the other patient-facing staff.

The third part of the survey assessed perceptions of safety culture using four previously validated questions from an inpatient survey (e.g. whether respondents agreed that practice managers have a clear picture of safety risks, that they have enough resources to provide safe patient care, they feel safe speaking up about a problem, and there is response when someone speaks up about patient safety problems). Cronbach's alpha coefficient was 0.84 for these items and the same for attending and resident clinicians and other patient-facing staff.

Survey item non-response

For team dynamics and perceptions of safety culture items, non-response was extremely low at <1.5%. Non-response for care coordination items was at 6.3% overall, driven by other patient-facing staff who were less likely than attending clinicians and residents to respond to these questions. We used descriptive statistics to evaluate demographic characteristics of the study sample, including age, gender, race/ethnicity, job title and practice site.

Analysis

Descriptive statistics provided the frequency and average of response options stratified by professional role: attending clinicians, residents and other patient-facing staff. We used *t*-tests and ANOVA to compare differences between role groups. For each respondent, we calculated an overall team dynamics score by taking the mean response across all 33 items and for each of the eight team dynamic domains, removing not-applicable and missing responses where appropriate. We followed the same process for our dependent variable domain—perceptions of safety culture, and for our hypothesized mediator, care coordination.

We used linear regression to examine the relationships between the independent variable, overall team dynamics, and the dependent variable, perceptions of safety culture. We controlled for all available demographic characteristics of respondents including age, gender

and race/ethnicity. We also adjusted for whether the primary care practice site was a hospital-based or community-based practice.

To determine whether care coordination was a potential mediator between team dynamics and perceptions of safety culture, we performed a mediation analysis using the process described by Baron and Kenny (17). The goal of the mediation test was to assess the total effect of overall team dynamics, our independent variable, on perceptions of safety culture through both direct and indirect effects. To do this, we ran two additional linear regressions, one looking at the relationship of the independent variable (overall team dynamics) with the mediator (care coordination) and the other assessing the relationship of the mediator (care coordination) with the dependent variable (perceptions of safety culture) while controlling for the independent variable (overall team dynamics). We also tested for the significance of the indirect effect or the mediating effect of care coordination on the relationship between team dynamics and perceptions of safety culture and calculated the per cent of total effect mediated, using the Sobel test of mediation (18). The Sobel test is used to test the significance of the mediating effect by determining whether the beta for the independent variable (overall team dynamics) is significantly different when the mediator is in the model.

For all of the analyses mentioned earlier, we conducted unadjusted analyses on the group as a whole and for each of the different professional roles: attending clinicians, resident physicians and other patient-facing staff. When available, we adjusted for age, sex, race/ethnicity and practice site (hospital-based practice versus community-based practice). For all analyses, we used heteroskedasticity robust standard errors clustered by primary care practice. We performed all analyses using SAS statistical software version 9.4.

Subgroup analysis

Because resident physicians often spend less time at their primary care practice site and have fewer opportunities to be connected with team dynamics and to be aware of patient safety culture, we also repeated the analyses excluding resident physicians.

Results

Response rates

Of the 1716 staff who received the survey, 1082 responded for a response rate of 63.1%. We received 1082 responses from 256 attending clinicians, 253 resident physicians and 573 other patient-facing staff.

Study population

The majority of the respondents were females (74.8%); women comprised 64.8% of attending clinicians, 56.5% of resident physicians and 87.3% of other patient-facing staff. The mean (SD) age for attending clinicians was 48.4 (11.4), and the mean age for other patient-facing staff was 41.4 (12.8). The majority of attending clinicians were non-Hispanic White (73.8%), and about half (49.2%) of other patient-facing staff were non-Hispanic White (Table 1).

Level of team dynamics, safety culture and care coordination

Ratings of team dynamics, perceptions of safety culture and care coordination were all on the positive side of neutral—ratings of perceptions of safety culture were the most positive while ratings of care coordination were most neutral. For all respondents (*n* = 1082), the

Table 1. Demographic characteristics of respondents to a survey assessing primary care team dynamics, safety culture and care coordination in primary care, all respondents and by role on the primary care team

Characteristics	All respondents (<i>n</i> = 1082)	Attending clinicians (<i>n</i> = 256) ^a	Resident physicians (<i>n</i> = 253) ^b	Other patient-facing staff (<i>n</i> = 573)
Gender, <i>n</i> (%)				
Male	255 (23.6)	88 (34.4)	110 (43.5)	57 (9.9)
Female	809 (74.8)	166 (64.8)	143 (56.5)	500 (87.3)
Declined to answer	18 (1.7)	2 (0.8)	0	16 (2.8)
Age				
<30, <i>n</i> (%)	107 (9.9)	2 (0.8)	–	105 (18.3)
30–35	123 (11.4)	35 (13.7)	–	88 (15.4)
36–50	251 (23.2)	102 (39.8)	–	149 (26.0)
>50	233 (21.5)	96 (37.5)	–	137 (23.9)
Declined to answer	368 (34.0)	21 (8.2)	–	94 (16.4)
Race or ethnicity, <i>n</i> (%)				
White	471 (43.5)	189 (73.8)	–	282 (49.2)
Hispanic	151 (14.0)	14 (5.5)	–	137 (23.9)
African American	59 (5.5)	9 (3.5)	–	50 (8.7)
Asian/Pacific Islander	45 (4.2)	26 (10.2)	–	19 (3.3)
American Indian/Alaska Native	6 (0.6)	1 (0.4)	–	5 (0.9)
Others	42 (3.9)	8 (3.1)	–	34 (5.9)
Declined to answer	308 (28.5)	9 (3.5)	–	46 (8.0)
Practice site, <i>n</i> (%)				
Hospital-based practice	599 (55.4)	150 (58.6)	199 (78.7)	250 (43.6)
Community-based practice	483 (44.6)	106 (41.4)	54 (21.3)	323 (56.4)

^aAttending clinicians refer to all Doctors of Medicine (MDs), Physician Assistants (PAs) and Nurse Practitioners (NPs). PAs and NPs account for 12% of the attending clinicians.

^bInformation on age and race/ethnicity was not collected in the resident physician survey.

mean (SD) of overall team dynamics was neutral to positive at 3.79 (0.60) on a 5-point scale. Mean levels of reported team dynamics were significantly different between the three professional role groups ($F = 7.83$, $P < 0.001$). Attending clinicians reported the lowest average level of team dynamics at 3.68 (0.60), compared with residents at 3.76 (0.58) ($t = 1.61$, $P = 0.11$), and other patient-facing staff reported the highest levels at 3.84 (0.60) ($t = 3.67$, $P = 0.001$) (Table 2).

Overall, perceptions of safety culture were also on the positive side of neutral at 3.85 (0.72) on a 5-point scale and differences between professional groups only bordered on statistical significance ($F = 2.78$, $P = 0.06$).

Across the study population, care coordination was rated 3.55 (0.90), indicating slightly less agreement with statements. In contrast to the other survey domains, other patient-facing staff reported the lowest average level of care coordination at 3.40 (1.09), residents remained in the moderate position at 3.66 (0.64), and attending clinicians at 3.76 (0.77) had the highest levels. The difference between all groups ($F = 17.5$, $P < 0.001$) as well as other patient-facing staff and both attending and resident clinicians were statistically significant ($t = 6.32$ and $t = 4.19$ $P < 0.001$, respectively).

Team dynamics and perceptions of safety culture

Overall, for every 1-point increase in overall team dynamics, perception of safety culture increased 0.76 point on a 5-point Likert scale [95% confidence interval (CI) 0.70–0.82, $P < 0.001$]. This relationship was significant for all three professional groups (all $P < 0.001$) in both unadjusted and adjusted models (Table 3).

Patient care coordination as a mediator of team dynamics and perception of safety culture

For all respondents, both the relationship of overall team dynamics and care coordination (95% CI 0.33–0.47, $P < 0.001$) and the relationship

of care coordination and perceptions of safety culture were significant (95% CI 0.058–0.128, $P < 0.001$). Results from the Sobel test indicated that the association between overall team dynamics and the perception of safety culture is significantly mediated by care coordination ($t = 4.51$, $P < 0.001$) for the sample overall (Table 4, Supplementary Figure S1). However, care coordination only partially mediated this relationship. That is, the direct effect of overall team dynamics on perceptions of safety culture when controlling for care coordination remained significant for the full sample (Supplementary Figure S1).

In our analysis stratified by professional role, we found that care coordination mediated the relationship between team dynamics and perceptions of safety culture for each role group. Additionally, while care coordination was found to be a partial mediator, it only explained a small amount of the total effect on the relationship between team dynamics and perceptions of safety culture across all role groups (4.67% for the whole cohort, 6.95% for attending clinicians, 8.15% for resident physicians and 5.60% for other patient-facing staff) (Table 4).

Subgroup analysis

When we excluded residents from the cohort, we found no differences in observed relationships. That is, we again found a strong positive relationship between team dynamics and perceptions of safety culture and that care coordination remained a significant partial mediator.

Discussion

Our study finds a significant and positive relationship between primary care practice personnel's perceptions of overall team dynamics and their perceptions of safety culture, and this relationship is partially mediated by ratings of care coordination. To our knowledge,

Table 2. Average levels of team dynamics, care coordination and perceptions of safety culture among survey respondents, all respondents and by role on the primary care team

Variables	All respondents (<i>n</i> = 1082)	Attending clinicians (<i>n</i> = 256)	Resident physicians (<i>n</i> = 253)	Other patient-facing staff (<i>n</i> = 573)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Primary care team dynamics factors				
Conditions for team effectiveness	3.66 (0.70)	3.53 (0.74)	3.62 (0.66)	3.74(0.69)
Shared understanding	3.89 (0.62)	3.81 (0.61)	3.86 (0.62)	3.94 (0.61)
Processes for communication and information exchange	3.72 (0.73)	3.48 (0.75)	3.70 (0.71)	3.84 (0.71)
Processes for accountability	3.53 (0.98)	3.17 (1.05)	3.54 (0.94)	3.70 (0.93)
Processes for conflict resolution	3.46 (0.87)	3.25 (0.85)	3.58 (0.73)	3.52 (0.91)
Acting and feeling like a team	4.07 (0.62)	4.13 (0.56)	4.10 (0.62)	4.02 (0.64)
Perceived team effectiveness	3.79 (0.75)	3.70 (0.77)	3.73 (0.75)	3.83 (0.74)
Learning activities	3.62 (0.75)	3.49 (0.75)	3.51 (0.76)	3.73 (0.73)
Overall team dynamics ^a	3.79 (0.60)	3.68 (0.60)	3.76 (0.58)	3.84 (0.60)
Care coordination	3.55 (0.90)	3.77 (0.55)	3.66 (0.64)	3.40 (1.09)
Perception of safety culture	3.85 (0.72)	3.76 (0.77)	3.90 (0.59)	3.87 (0.74)

All items used a 5-point Likert response scale (1 = strongly disagree to 5 = strongly agree).

^aOverall team dynamics is an average of the questions that make up the eight factors assessing primary care team dynamics.

Table 3. Results from unadjusted and adjusted analyses of the relationship between overall team dynamics and perceived safety culture in primary care, all respondents and by role on the primary care team

	All respondents	Attending clinicians	Resident physicians	Other patient-facing staff
Overall team dynamics				
Unadjusted (95% CI)	0.75 (0.69–0.81)* <i>n</i> = 1074	0.77 (0.67–0.87)* <i>n</i> = 256	0.65 (0.53–0.77)* <i>n</i> = 250	0.78 (0.68–0.88)* <i>n</i> = 568
Adjusted (95% CI)	0.76 (0.70–0.82)* ^a <i>n</i> = 991	0.75 (0.63–0.87)* <i>n</i> = 246	0.66 (0.54–0.78)* <i>n</i> = 250	0.80 (0.70–0.90)* <i>n</i> = 517

CI, confidence interval.

Dependent variable = perception of safety culture. Standard errors were clustered by primary care practice.

^aAll respondent adjusted model and resident physician models were only adjusted for sex, provider type and practice site (community versus hospital based) given that these were the only covariates available for all respondents and resident physicians. The attending clinicians and other patient-facing staff models were adjusted for age, sex, race/ethnicity and practice site.

**P* < 0.001.

this is the first examination of the relationship between team dynamics, perceptions of safety culture and care coordination within the primary care setting (7,9,19,20). It is innovative because it examines the role that care coordination—a major focus in health care today—plays in mediating the relationship between team dynamics and perceived safety culture.

Our findings are consistent with prior work on team dynamics and safety culture from other industries and other areas of medicine (7,19,21) and extend our understanding of the degree to which care coordination—perhaps by improving processes of care delivery and patterns of behaviour such as through closing communication loops, confirming that critical tests are completed or following up abnormal test results—makes providers feel that their practice is prioritizing safety and delivering safer and more reliable care.

Our results, however, suggest that care coordination accounted for a small portion of the relationship between team dynamics and perceptions of safety culture. One potential explanation for why care coordination only partially mediated this relationship is that team dynamics may improve safety culture through mechanisms other than care coordination. For example, high-functioning teams could improve safety culture by increasing feelings of mutual respect and trust that team members can and will keep patients safe. High-functioning teams may also decrease hierarchy and increase

psychological safety in ways that promote willingness of team members to speak up about safety concerns. These mechanisms may account for the relationship between team dynamics and perceptions of safety culture beyond the benefits of teams to care coordination.

This study has limitations. It is a cross-sectional study based on perceptions among primary care personnel in the USA. Perceptions are, however, important, especially where team dynamics are concerned because dynamics are based on individuals' experiences, as indicated by the differences experienced between the physician and non-physician professional groups. Future work would benefit from efforts to link perceptions to alternate measures of safety (e.g. event counts) and coordination (e.g. patients' perspective). Also, our questions for care coordination were general, but can provide a foundation for more aspects of coordination (e.g. the quality of the systems supports for appropriate handoffs, or who specifically does what when coordinating across different teams, professional groups and health systems) as opposed to the interpersonal features of team relationships. Additionally, some of the care coordination questions may be physician centred and therefore may not have been applicable to the daily tasks of the other patient-facing providers. Further research to clarify the role of care coordination in safety culture could support new item development. Lastly, although this study was conducted in the USA, we expect the general relationship between team

Table 4. Results of a mediation analysis investigating whether care coordination mediates the relationship between team dynamics and safety culture in primary care, all respondents and by role on the primary care team

	Team dynamics on perception of safety culture ^a	Team dynamics on care coordination ^b	Care coordination on perception of safety culture given team dynamics ^c	Team dynamics on perception of safety culture given care coordination ^d	Per cent of total effect mediated	P-Value Sobel test (<i>t</i> value)
	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	%	—
All respondents	0.761 (0.702–0.820)**	0.399 (0.326–0.472)**	0.093 (0.058–0.128)**	0.733 (0.684–0.782)**	4.67	<0.001 (4.50)
Attending Clinicians	0.752 (0.634–0.870)**	0.337 (0.200–0.474)**	0.166 (0.025–0.307)*	0.703 (0.580–0.826)**	6.95	0.038 (2.08)
Residents	0.659 (0.539–0.781)**	0.450 (0.297–0.603)**	0.130 (0.120–0.140)*	0.608 (0.506–0.710)**	8.15	0.019 (2.34)
Other patient-facing staff	0.802 (0.698–0.906)**	0.427 (0.315–0.539)**	0.093 (0.046–0.140)**	0.781 (0.656–0.906)**	4.73	0.001 (3.48)

All results were adjusted for gender, practice site (hospital based versus community based). For the analyses for the attending clinicians and other patient-facing providers, results were also adjusted for age and race/ethnicity. Standard errors were also heteroskedasticity robust and clustered by primary care practice. CI, confidence interval.

^aTotal effect of team dynamics on perception of safety culture.

^bTotal effect of team dynamics on care coordination.

^cEffect of care coordination on perception of safety culture controlling for team dynamics.

^dDirect effect of team dynamics on perception of safety culture controlling for care coordination.

* $P < 0.05$, ** $P < 0.01$.

dynamics, care coordination and safety culture to be applicable and important to non-US settings. This is especially true as health care systems move towards team-based care as a means of better managing chronic disease in ambulatory settings. Future work should test this relationship both nationally and internationally.

Our findings support a positive relationship between overall perceptions of team dynamics and perceptions of safety culture. Further research is needed to clarify what other factors mediate this relationship. Regardless of the directionality of the relationship between team dynamics and perceptions of safety culture, the relationship is positive. Ultimately, investment by primary care to improve care coordination remains critical for its potential to improve both safety culture and quality and delivery of primary care.

Supplementary Material

Supplementary data are available at *Family Practice* online.

Declaration

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Conflict of interest: The authors declare that they do not have any conflicts of interest related to this research.

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