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# The benefits of agreeing on what matters most: Team cooperative norms mediate the effect of co-leaders' shared goals on safety climate in neonatal intensive care units

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**Background:** Safety climate research suggests that a corresponding climate in work units is crucial for patient safety. Intensive care units are usually co-led by a nurse and a physician, who are responsible for aligning an interprofessional workforce and warrant a high level of safety. Yet, little is known about whether and how these interprofessional co-leaders jointly affect their unit's safety climate.

**Purpose:** This empirical study aims to explain differences in the units' safety climate as an outcome of the nurse and physician leaders' degree of shared goals. Specifically, we examine whether the degree to which co-leaders

**Key words:** co-leaders, cooperative norms, interprofessional cooperation, safety climate

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share goals in general fosters a safety climate by pronouncing norms of interprofessional cooperation as a behavioral standard for the team members' interactions.

**Methodology/Approach:** A cross-sectional design was used to gather data from 70 neonatal intensive care units (NICUs) in Germany. Survey data for our variables were collected from the unit's leading nurse and the leading physician, as well as from the unit's nursing and physician team members. Hypotheses testing at unit level was conducted using multivariate linear regression.

**Results:** Our analyses show that the extent to which nurse–physician co-leaders share goals covaries with safety climate in NICUs. This relationship is partially mediated by norms of interprofessional cooperation among NICU team members. Our final model accounts for 54% of the variability in safety climate of NICUs.

**Conclusion:** Increasing the extent to which co-leaders share goals is an effective lever to strengthen interprofessional cooperation and foster a safety climate among nursing and physician team members of hospital units.

Intensive care units are safety-sensitive environments characterized by high task interdependency (e.g., Manser, 2009). Because errors can be highly consequential and technological complexity and vulnerable patients demand a reliable information flow between physicians and nurses (Weller, Boyd, & Cumin, 2014), a climate for safety shared among team members of different professions is essential. Supporting this relationship, research has linked safety climate to patient outcomes (Singer, Lin, Falwell, Gaba, & Baker, 2009) and medication error rates (Steyrer, Schiffinger, Huber, Valentin, & Strunk, 2013).

The two professions working in intensive care units—nurses and physicians—often espouse substantially different goals (Garman, Leach, & Spector, 2006), and these differences may threaten patient safety (Weller et al., 2014). The extent to which members of different professions share goals is particularly relevant for the nurse and physician co-leaders of a unit, because of the power that is “structurally embedded” (Denis, Langley, & Sergi, 2012, p. 231) within co-leadership dyads. Whether the extent to which these co-leaders share goals affects their unit's safety climate—and what mechanism may translate this effect to the team level—remains only barely studied. In consequence, we know little about whether and why interprofessional leaders bridge the professional divide in their health care teams—as opposed to fortifying this divide. This scant research becomes apparent in our limited understanding of what renders physicians and nurses in co-leadership positions—that is, bearers of complementary knowledge and skill sets (Denis, Langley, & Rouleau, 2010; Garman et al., 2006)—effective. The continuing lack of research on interprofessional constellations leaves scholars and managers puzzling whether and why shared goals among leaders drive shared perceptions of safety among staff.

Our study aims to address these shortcomings by theorizing and analyzing the impact of shared goals between nurse and physician co-leaders on safety climate in neonatal intensive care units (NICUs). By theorizing and testing the mediating effect of norms for interprofessional cooperation among NICU team members, we also introduce a

mechanism that explains how the extent of shared goals affects safety climate, thus highlighting the potential of interprofessional co-leader constellations to foster cooperation between nursing and physician team members. These insights have implications for our understanding of nurse–physician co-leadership; they uncover previously overlooked connections between co-leader configurations and safety climate, and they also offer managerial implications.

## Theory and Conceptual Background

In general, a work climate captures the unit members' shared perceptions of their common social environment (Zohar & Hofmann, 2012). One particularly relevant climate domain in health care is a unit's climate of safety—that is, the shared perceptions toward the importance of safety-oriented behaviors, procedures, or activities (Zohar & Hofmann, 2012).

Previous research has consistently highlighted the importance of leader commitment to safety to foster a work climate focused on safety (e.g., Hofmann & Morgeson, 1999; Zohar, 1980). Through actions that value safety and the display of safety concerns, leaders can inform their team members about behavioral expectations (Zohar & Hofmann, 2012). Subsequent research established a link between (dimensions of) safety climate and organizational outcomes, such as safety communication perceived by employees and work accidents (Hofmann & Morgeson, 1999).

Intensive care units—an environment where a climate of safety is essential—are often led by leaders of two different professions—that is, a nurse and a physician (Clausen et al., 2017; Thude, Thomsen, Stenager, & Hollnagel, 2017). In general, such co-leaders can pursue different day-to-day goals that result from their different tasks, roles, and responsibilities due to their task-related specialization and differentiation (Denis et al., 2010).

Although their day-to-day goals may differ, these co-leaders may nevertheless experience a feeling of “being on the same page.” Such generally shared goals provide

an important foundation for a common task motivation (Locke & Latham, 2002). Shared goals reflect the degree to which individuals exhibit common goals, missions, and visions (Chow & Chan, 2008) and the degree to which they work for a common purpose (Locke & Latham, 2002). Shared goals have been shown to foster the willingness to share knowledge with organizational members (Chow & Chan, 2008). Specifically, DeJoy, Schaffer, Wilson, Vandenberg, and Butts (2004) showed that an organizational climate covering the ease of information sharing and communication benefits the safety climate as perceived by individual workers.

These arguments suggest that the extent to which NICU co-leaders generally share goals will benefit their exchange of safety- and treatment-related information. Such knowledge sharing demonstrates an active concern for safety and hands-on participation in safety activities. Because co-leaders function as examples to their followers, their safety-related behavior should also support the perceived importance of safety-related behavior among their followers across professional boundaries, thus boosting the unit's safety climate. Therefore, we hypothesize the following:

*Hypothesis 1. The extent to which nurse and physician co-leaders share goals positively influences their unit's safety climate.*

Although our above argument points out the relation between co-leaders' shared goals and their unit's safety climate, our argument has only touched upon cooperation in that unit. In the following section, we will focus on this particularly relevant antecedent of unit safety climate: norms of interprofessional cooperation in a unit. Team norms function as informal rules among team members and limit the range of expected behavior to those behaviors that are helpful for team functioning and task achievement (Hackman, 1992). Teams develop norms regarding behaviors that are essential for task accomplishment through interactions with leaders and co-workers (Feldman, 1984). For example, Taggar and Ellis (2007) revealed that a leader's expectations toward collaborative problem-solving function as the main driver in shaping the corresponding norms within newly formed teams. Shared superordinate goals between interprofessional co-leaders can work as a means to support the integration of two conflicting social groups and overcome conflicting agendas for the purpose of goal achievement (Locke & Latham, 2002). Ultimately, norms toward interprofessional cooperation should manifest themselves as rules for interprofessional interaction within the unit. Findings from qualitative research support the notion that a common understanding and perception of mutual necessity among nurse-physician co-leaders can help to align distinct professional agendas (Clausen et al., 2017). Therefore, expanding on the function of expectations and the

behavior of leaders for team members' attitudes and behaviors, we hypothesize the following:

*Hypothesis 2. The extent to which nurse and physician co-leaders share goals positively influences team norms toward interprofessional cooperation among nurses and physicians.*

Patient safety is affected by cooperation between nurses and physicians, as suggested by research linking norms that support the open communication of safety concerns to safety climate among hospital staff (Zaheer, Ginsburg, Chuang, & Grace, 2015). Norms toward interprofessional cooperation may comprise the exchange of information and the integration of complementary bases of knowledge or specialized skills. In the case of nurses and physicians, interprofessional cooperative norms should lead to increased interprofessional exchange that values both the view of nurses and physicians. Particularly, cooperation should help to overcome educational or psychological barriers for information sharing, thereby supporting the effectiveness of the whole team (Weller et al., 2014). In support of this, Chatman and Flynn (2001) showed that cooperative norms in a team predict team effectiveness and efficiency in problem solving. Conversely, not sharing information is the opposite of safety-related behavior and may be traced back to prevailing professional boundaries (Weller et al., 2014). As a consequence, obstacles to open communication among both professions are reduced, leading to increased safety-relevant behavior within the team. We thus argue:

*Hypothesis 3. Team norms toward interprofessional cooperation among nurses and physicians positively affect safety climate.*

Finally, by logical expansion of Hypotheses 1–3 above, the effect of the leaders' shared goals on safety climate should result from the strengthening of cooperative norms among team members. Through their impact on norms toward interprofessional cooperation, co-leaders should foster the shared perception of safety as a priority among team members. Because other explanations exist through which leaders can impact a unit's safety climate, this relationship should be partially mediated. For example, safety-associated programs and policies, such as available training and equipment, have also been identified as predictors that support the priority for safety as perceived by workers (DeJoy et al., 2004). Furthermore, practices such as leadership walk rounds have been shown to be positively associated with a unit's safety climate (Frankel et al., 2008). We therefore argue the following:

*Hypothesis 4. The positive relationship between the extent to which nurse and physician co-leaders share goals and safety climate is partially mediated by cooperative norms between nurses and physicians.*

## Method

### Study Sample

We conducted a survey in German NICUs between September 2015 and August 2016. To identify members of our population, we used public reports and web-based searches. A total number of 224 NICUs in Germany was identified, as well as the corresponding nurse and physician leaders. For those units where web searches revealed no information on leadership positions, telephone calls were made to ask for the respective nurse and/or physician leader. In a next step, both leaders were approached separately and invited to take part in our study. This approach ensured that the co-leadership structure was recognized from the outset of the study and that both professions felt equally valued. Moreover, each leader was able to decide independently whether or not the NICU should participate in our study because valid participation required written consent from both leaders. In 86 of the 224 approached NICUs, both leaders agreed to participate in our study, which corresponds to a 38% response rate. A completed consent form from either a nurse or a physician leader was received from 12 NICUs. In 8 of these 12 cases, the nurse leader responded; hence, the response rate to our study was slightly higher among nurse leaders.

In the written consent form, each of the two leaders stated the number of corresponding staff members, that is, nurses or physicians who were working in the NICU with at least 50% of a full-time equivalent. A package that contained the corresponding number of team questionnaires was then sent to the respective leader of each profession, with the request to distribute the team surveys during meetings of the respective group. Aside from team questionnaires, each leader received a personalized leader questionnaire. We used different surveys for leaders and team members. To account for different demographics (e.g., nurses in Germany usually complete vocational training, whereas physicians study in universities) and different structural characteristics, we also had a nursing version and a physician version of each survey. Because of the hierarchical structure of hospitals, physicians and nurses know who their respective leader is. In line with previous research in similar settings (e.g., Schiffinger, Latzke, & Steyrer, 2016; Steyrer et al., 2013) and because all members of each professional group executed similar tasks, our team questionnaire addressed all nursing as well as physician staff members. Note that, in contrast to other countries such as the United States, most physicians working in German hospitals, including the heads of clinical units, are hospital employees. Participation in the survey was voluntary, and confidentiality was guaranteed by invention of an independently operating data trust unit that managed survey responses. Postal reminders were sent to each of the unit leaders at 3 points in time.

Of the 86 units that agreed to participate, 76 physician leaders and 78 nurse leaders responded to our leader survey. In addition, we received team survey responses from 496 physician staff who were assigned to 80 different units and 1,406 valid responses from nursing staff working at 82 different units. Ten units were excluded from analyses because only the respective physician or nurse leader responded, leaving 72 units with complete co-leader responses. To avoid biased estimates due to incomplete data, we checked whether some units exhibited insufficient response rates using Dawson's (2003) selection rate. We followed prior studies (e.g., Richter, West, Van Dick, & Dawson, 2006) in choosing a cutoff selection rate ( $\leq .32$ )—which ensures that the data from the sample correlate with true scores to .95 or higher. No units were excluded based on this criterion. However, one unit had to be excluded because, for reasons unknown, only physician staff had completed questionnaires. To test whether a higher response rate was related to higher safety climate scores, the response rate per unit was correlated with our measure of safety climate in the sample. The correlation ( $r = .08$ ) was not significant, which indicates that units with a high/low response rate did not significantly differ in their perception of safety climate. Estimation requirements further reduced our data set by one unit. Specifically, to avoid biased estimates, we excluded one additional unit from subsequent analysis because the estimated fitted values in the final ordinary least squares model did not fall into the 0–1 bound to which our dependent variable was limited (Horrace & Oaxaca, 2006).

The final sample consists of 70 NICUs, each with a co-leadership dyad that comprises the leading nurse and the leading physician. Overall, the team sample encompasses responses from 1,182 nurses and 440 physicians from 70 NICUs, with an average of 23 responses and an average response rate of 53% (min: 22%, max: 88%) per unit. Compared to the total number of eligible staff in these NICUs, 59% of all physician staff and 49% of all nursing staff returned a valid questionnaire. Ethics approval for our study was obtained from the ethical board at the University Hospital of Cologne.

### Measures

Because our hypotheses focus on the co-leaders of a NICU and the NICU team, our single level of analysis was the NICU. We measured our study variables using scales that have been developed and applied in previous research. The team surveys and the leader surveys were pretested to ensure applicability and understandability. The team survey was pretested during interviews with nursing and physician staff from pediatrics, following a think-aloud approach (Collins, 2003). The same applied to the leader survey, which was pretested with active and retired nurse and physician leaders. Because our variables reflect unit-level measures,

variables had to be aggregated at the NICU level prior to hypothesis testing. To justify aggregation at the level of the co-leader dyad or the NICU, we calculated intraclass correlation coefficients ICC(1) and ICC(2) (Bliese, 2000). Moreover, the average within-group interrater agreement  $r_{WG(j)}$  among all units, based on James, Demaree, and Wolf (1984), was calculated to assess the consensus of ratings and to infer the presence of a shared perception among the staff members. For each scale, internal consistency was assessed by Cronbach's alpha. Table 1 provides an overview on the results of the analysis of variance (ANOVA) and the corresponding values for ICC(1) and ICC(2) for each of the scales.

**Shared goals.** We measured shared goals using a perceptual measure—that is, we measured the degree to which the nurse and physician leaders perceived that they mutually agree on common goals in general and hold common visions and ambitions for the NICU. We slightly adapted a German-language scale developed by Hannemann-Weber and Schultz (2014), meaning that items were rephrased to reference the nurse and/or physician leader on the NICU. The scale comprised four items that were measured on a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), for example, “The nurse and physician leader on this NICU share the same ambitions and visions at work.” The items did not target any specific goal dimension (e.g., safety goals), and each of the two leaders rated the four items independently within the respective leader survey. The scale showed sufficient internal consistency ( $\alpha = .88$ ) and good interrater agreement with  $r_{WG(j)} = .88$ . Interrater reliability and agreement were examined in order to justify aggregation of each co-leader's composite score at the unit of analysis, that is, the dyad level. The one-way ANOVA,  $F(69, 70) = 1.54, p = .038$ , demonstrated a significant amount of variance between the units with an ICC(1) of .21 and an ICC(2) of .35. Despite sufficient between-unit variance, the ICC(2) is comparatively low—a phenomenon that is known in the organizational behavior literature, often resulting from strong cultures (such as professional norms) impacting all groups in the sample (Chen & Bliese, 2002). The mean level of shared goals for a unit was calculated as the average of the nurse and physician leaders' scale composite score.

**Cooperative norms.** Cooperative norms measured the degree to which employees perceived that cooperation between the nursing and physician staff was valued and expected. The 5-item scale was developed by Chatman and Flynn (2001) and translated into German by in-depth discussion with a bilingual (German/English) psychologist with expertise in item translation. In order to measure the respondents' perceptions of norms toward interprofessional cooperation in particular, slight adaptations were made to the original scale. More precisely, instead of referencing the team as a whole, our items targeted cooperation between the nurses and physicians working at the respective NICU. For example, one item asked whether “There is a high level of cooperation among the members of the medical and the nursing service.” Respondents rated their perception on a 7-point Likert scale, ranging from 1 (*completely disagree*) to 7 (*completely agree*). The results of the ANOVA were  $F(69, 1552) = 5.19, p < .001$ , with an ICC(1) at .15 and an ICC(2) of .81. The scale showed acceptable internal consistency ( $\alpha = .78$ ) and good interrater agreement with  $r_{WG(j)} = .86$ . Based on these results for interrater agreement and interrater reliability, individual-level scores of nursing and physician staff members were aggregated at the unit level.

**Safety climate.** Strictly in line with past research in neonatal intensive care settings (e.g., Profit et al., 2011), safety climate—our dependent variable—was measured as the percentage of positive responses toward safety climate within each NICU, using the 7-item scale within the Safety Attitudes Questionnaire developed by Sexton et al. (2006), in the German language version by Zimmermann et al. (2013). For example, respondents rated the statement “In this NICU, it is difficult to discuss mistakes” on a 7-point Likert scale, with 1 reflecting *complete disagreement* and 7 denoting *complete agreement*. The scale showed sufficient internal consistency ( $\alpha = .83$ ) with good interrater agreement with  $r_{WG(j)} = .86$ . The one-way ANOVA,  $F(69, 1552) = 5.17, p < .001$ , with an ICC(1) = .15 and ICC(2) = .81, supports our intention to calculate a safety climate score for each NICU and search for factors that explain variance across units. In order to calculate the

Table 1

## Scales used in the questionnaires, their structure and psychometric properties (N = 70)

Construct/scale	Survey	No. items	ICC(1)	ICC(2)	F-value ANOVA	p-Value ANOVA
Shared goals	Leader survey	4	.21	.35	1.54	.038
Cooperative norms	Team survey	5	.15	.81	5.19	<.001
Safety climate	Team survey	7	.15	.81	5.17	<.001

Note. ICC = intraclass correlation; ANOVA = analysis of variance.

percentage of positive responses as a unit-level measure, initial scale computation instructions were adapted to our 7-point scale. Specifically, based on Safety Attitudes Questionnaire computation instructions, we first calculated a composition score for each individual team member by calculating the items-based mean values. Second, each respondent's score on this scale was transferred into a score that ranged between 0 (equals 1 on the 7-point Likert scale) and 100 (equals 7 on the 7-point Likert scale). A positive perception of safety climate required a scale score that was at least 75, which corresponds to a respondent's composition score of 5.5 on the scale. The final measure at the NICU level was created by taking the percentage of positive responses to safety climate within each unit, which was normalized to an interval scale ranging from 0 to 1.

**Control variables.** We added additional covariates to our model to control for possible confounding effects that relate to the characteristics of the unit or the co-leaders. First, patient volume is a much-debated quantity in neonatal care of very low birth weight infants due to its possible association with outcomes such as mortality. We therefore used the physician leader's report on the number of cases treated in 2014 with an age equal to or below 28 days as a control variable at the NICU level. In three cases, NICUs were eligible for inclusion in our study sample but had missing values in 2014. To retain these NICUs for our model estimation, we predicted the values on this variable by using regression imputation. Second, research suggests that the physicians' and nurses' perceptions of safety culture differ, with nurses reporting lower levels of safety culture (e.g., Profit et al., 2011). In order to account for differing perceptions among nurses and physicians, we added the share of the physician population working at the NICU as a control variable at the NICU level. Third, team size was included as a control variable because of the possibly inhibiting effect the number of team members might have on leadership activities and teamwork (e.g., Chatman & Flynn, 2001). Team size was measured as the number of nurses and physicians working at the NICU, as stated by the nurse and physician leaders in the respective questionnaires. Fourth, the literature suggests that teams pass several stages of team development across time and that higher stages of development are associated with improved teamwork (Wheelan, Burchill, & Tilin, 2003). The median tenure of team members in the NICU was added as a control variable to account for the effects of higher developmental states on teamwork and safety behavior. At the level of the co-leaders, we included the average tenure of the leadership dyad in years as covariate.

### Statistical Model

Multivariate regression analyses were applied to test our hypotheses. We used  $z$ -standardized transformations for all independent variables that were included in our three regression models. Model 1 was estimated to test the relationship

between shared goals of the nurse and physician co-leaders and safety climate among the nursing and physician team. Cooperative norms were regressed on leaders' shared goals in Model 2 to test for our second hypothesis. Model 3 extended Model 1 by including cooperative norms as an additional explanatory variable. This model was estimated to test our third hypothesis, proposing an effect of cooperative norms on safety climate. All regressions were estimated using the regression command with robust standard errors implemented in Stata Version 14.

Hypothesis 4 was tested following the requirements for mediation formulated by Baron and Kenny (1986). Partial mediation can be assumed if inclusion of the mediating variable causes a significant reduction in the direct effect (here: extent of shared goals on safety climate). To test for partial mediation, the difference in the shared goals coefficient between Model 1 and Model 3 was tested for significance by using seemingly unrelated postestimation. As suggested, additional tests for mediation were conducted in order to assess the strength of the indirect effect (Preacher & Hayes, 2004). These tests comprised a Sobel test for mediation with and without bootstrapped confidence intervals (CIs) with 1,000 replications. Bootstrapped CIs can provide a more valid estimate compared to the standard procedure, because the indirect effect is computed by repeatedly drawing a total of 1,000 random samples from the data set (Preacher & Hayes, 2004).

Because the mediator and dependent variable in our data both reflect responses from NICU nursing and physician team members, common method variance could bias our analysis. To address this issue, we followed previous survey-based research (e.g., Schiffinger et al., 2016) and conducted additional robustness tests to check for a possible single-source bias. We used four different procedures to split each NICU into two halves and calculated each of the two variables by using one half-unit. First, each observation in each NICU was assigned a random number; these observations were then sorted in ascending order. Then, based on the random numbers, the NICU was split into a lower half and an upper half. Second, we assigned running numbers to the observations in the sample and split each NICU into two halves by pooling odd and even numbers. Third, we generated two groups within each NICU by creating a new variable that selected 50% of all observations within each NICU based on random numbers. This procedure was repeated one more time to build a fourth sample. Model 3 was rerun for each of these split samples to test whether the proposed relationships between the mediator and dependent variable remained statistically significant.

In addition, as our safety climate variable was range-limited (0–1), we applied a fractional response regression modeling (Papke & Wooldridge, 1996) as an additional robustness check to estimate the effects of shared goals and cooperative norms on safety climate (Model 3). Fractional probit regression estimates the predicted values on a probit

**Table 2**  
Descriptive statistics and variable correlations (N = 70)

Variable	M	SD	1	2	3	4	5	6	7
1. Safety climate	0.34	0.2							
2. Cooperative norms	5.4	0.46	.69***						
3. Shared goals	5.7	0.8	.35**	.31*					
4. Co-leader tenure (years)	6.3	5.2	.29*	.19	-.09				
5. NICU cases	383	162	-.26*	-.19	-.27*	.11			
6. Team size (heads)	45	14	-.30*	-.24*	-.24*	-.07	.52***		
7. Team tenure (years)	6.5	3.7	.28*	.09	-.16	.31**	-.04	.06	
8. Unit share of physicians	0.25	0.09	-.02	.03	.07	-.13	-.19	-.33**	-.13

Note. NICU = neonatal intensive care unit.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

function and hence ensures that the predicted values are between 0 and 1.

## Results

Table 2 shows the means, standard deviations, and correlations for all variables. Bivariate analyses showed significant correlations of the safety climate with both cooperative norms ( $r = .69$ ,  $p < .001$ ) and shared goals ( $r = .35$ ,  $p = .003$ ) and between NICU cases and team size ( $r = .52$ ,  $p < .001$ ). The variance inflation factor for the independent variables across all models did not exceed 1.62 with a mean variance inflation factor of 1.30 across all explanatory variables, suggesting that multicollinearity was not a problem in our data.

Results for the three regression models are shown in Table 3. Our first hypothesis was supported by Model 1,

which showed a significant and positive relationship between shared goals among co-leaders and team perceptions of safety climate (0.07,  $p = .001$ ). Model 2 confirmed our second hypothesis by revealing a positive and significant linkage between the co-leaders' shared goals and cooperative norms (0.13,  $p = .019$ ).

Model 3 extended Model 1 by adding cooperative norms as an additional variable. Comparison of both models based on a likelihood ratio test confirmed that including cooperative norms as a predictor variable led to a significant improvement in model fit ( $\chi^2_{diff} = 33.57$ ,  $p < .001$ ). Model 3 estimated a strong positive linkage between cooperative norms and safety climate (0.11,  $p < .001$ ), which provided support for our third hypothesis as well as the mediation assumption stated above.

Finally, Table 3 illustrates the drop in significance for the shared goals coefficient from  $p = .001$  (0.07) in the model without cooperative norms to  $p = .033$  (0.04) in

**Table 3**  
Results of the multivariate regression analyses (N = 70)

Variable	Model 1 (DV: Safety climate)	Model 2 (DV: Cooperative norms)	Model 3 (DV: Safety climate)
Shared goals	0.07** (0.02)	0.13* (0.06)	0.04* (0.02)
Co-leader tenure (years)	0.05 (0.04)	0.08 (0.07)	0.03 (0.02)
NICU cases	-0.02 (0.02)	-0.03 (0.06)	-0.01 (0.02)
Team size (heads)	-0.04# (0.02)	-0.06 (0.05)	-0.02 (0.02)
Team tenure (years)	0.05* (0.02)	0.04 (0.05)	0.04* (0.02)
Unit share of physicians	-0.01 (0.02)	-0.01 (0.05)	-0.01 (0.02)
Cooperative norms			0.11*** (0.02)
Observations	70	70	70
Adjusted $R^2$	0.28	0.09	0.54
Change in model fit ( $p$ value)			<.001

Note. Ordinary least square regression; robust standard errors are in parentheses. DV = dependent variable; NICU = neonatal intensive care unit.

# $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$  (two-tailed).

Model 3, which included cooperative norms as predictor. Postestimation analyses (not reported in Table 3) based on seemingly unrelated estimations revealed that both coefficients were significantly different ( $p = .027$ ). This provided strong evidence regarding our fourth hypothesis about partial mediation. In line with this, the results of the Sobel test for mediation showed a significant indirect path ( $p = .027$ ) for the effect of shared goals on safety climate, with 47% of the total effect being mediated. Bootstrapping results underscored evidence for the indirect path (0.03,  $p = .042$ ) with a 95% bias-corrected CI [0.01, 0.07] that did not include zero. Thus, the results provided statistical support for the mediation hypothesis (see also Figure 1). Analyses based on fractional response regression confirmed both a drop in the shared goals coefficient from Model 1 (0.19,  $p < .001$ ) to Model 3 (0.10,  $p = .028$ ), as well as the significant association between cooperative norms and safety climate in Model 3 (0.32,  $p < .001$ ).

To adjust our results from a potential single-source bias, we used four different split-samples and calculated the mediator and dependent variable based on each of these samples. Model 3 was estimated based on the split-sample variables to test the significance of the relationship between cooperative norms and safety climate. All analyses confirmed our previous findings, estimating a positive and significant relationship between cooperative norms and safety climate in all of the four split samples. These results were confirmed when running the split-sample analyses by use of fractional response modeling.

## Discussion

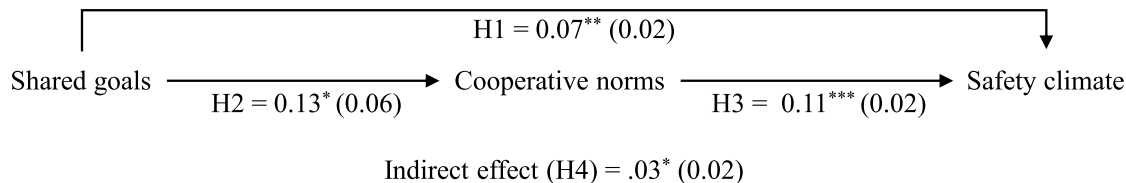
The aim of this article was to examine the role of shared goals between complementary co-leaders on cooperative norms and safety climate among intensive care unit staff. We found that the extent of shared goals between co-leaders in NICUs had an impact on safety climate at the

frontline of service provision. In addition, we identified team norms toward interprofessional cooperation among unit teams as a mediating mechanism that partially explained the co-leader–climate relationship. Hence, our results make a general contribution to calls for research to shed light on boundary conditions for effective co-leaders (Denis et al., 2012), placing emphasis on the benefits of the interprofessional co-leaders' shared goals. Moreover, we believe that our results are relevant to NICUs. Previous research that studied a comprehensive safety program in intensive care units suggests a rise by 10 percentage points in safety climate as relevant increase (Sexton et al., 2011). The results of our linear estimation suggest that increasing team cooperative norms by .46 (1 *SD*) on a 7-point Likert scale was associated with a rise in positive perceptions of safety climate by 11 percentage points among the unit staff.

Our findings indicate that in cases where plurality among leaders is “more structurally embedded” (Denis et al., 2012, p. 231)—as it is usually the case in interprofessional teams—in the form of complementary leadership of hospital units, future research should consider to include the two formal leaders. This might particularly apply if the professional backgrounds in the co-leadership dyad resemble the interdisciplinary workforce at the unit. In particular, mutual alignment and agreement about what is important for work might help co-leaders to make minor decisions individually and more quickly, without approaching the fellow co-leader, but still comply with the principle of speaking with one voice (Thude et al., 2017). Thereby, alignment could support co-leaders to pursue differentiation in practice and evolve as an influential leadership constellation (Denis et al., 2010). Ultimately, our study stresses that a perception of mutual alignment between both leaders is not only important for dynamics and processes within the dyad (Clausen et al., 2017) but can positively affect team members at the NICU.

**Figure 1**

### Partially mediated impact of shared goals on safety climate



*Note:* Model illustrating the results of hypotheses testing. Robust standard errors are in parentheses. Significance at \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$  (two-tailed).



Qualitative research points at several more dimensions that could influence how co-leaders work together (e.g., Clausen et al., 2017; Thude et al., 2017). It would, therefore, be interesting for future research to examine quantitatively if and how other configurations of co-leaders can affect the work of interprofessional teams in hospitals.

By examining the mediating effect of cooperative team norms, our results identify a teamwork mechanism through which these pairs possibly support patient safety. Because our results suggest a partial mediation, other factors besides cooperative norms, such as unit norms of openness (Zaheer et al., 2015), could also explain the positive association between co-leaders' shared goals and safety climate.

Moreover, our findings complement prior research that studied antecedents of safety climate and cooperative norms among teams. First, our results highlight the importance of relational factors as antecedents for the perceived importance of safety, which had already been suggested by previous research that considered the leader–member relationship quality (Hofmann & Morgeson, 1999). Second, previous research, for instance, points out that homogeneity with regard to the team members' demographic characteristics (Chatman & Flynn, 2001) has the potential to foster cooperative norms. Besides those factors, our findings propose that relational factors should be a promising avenue for further research on the emergence of cooperative norms and safety climate.

Our study has several limitations that should be taken into account when interpreting our results. First, because of the design of our study, we are not able to draw causal inferences for the proposed relationships. Second, because of part-time job models, formal leadership was assigned to more than one nurse or physician in some cases. In these cases, we proposed basing the decision about who should participate in our study on the level of interaction with the respective co-leading counterpart. As a consequence, the design of our study might have not completely captured all co-leaders within the NICU. Nevertheless, our approach allowed us to include the two most important co-leaders in those cases with formal leadership assigned to more than two people. Third, compared to a larger and representative sample covering about 60% of all perinatal centers in Germany (Blum, 2016), our sample contains NICUs that were equipped with a higher number of treatment and surveillance beds, treated more cases per year, and employed a higher number of nursing staff full-time equivalents. This may suggest that larger perinatal centers are overrepresented in our sample.

Finally, our findings are derived from studying NICUs in German hospitals. NICUs differ from other hospital units regarding structural and personnel characteristics, for example, staff-to-patient ratios. Past research showed that the mean percentage of positive responses of the NICU safety climate exceeds those in adult intensive care units (Proffit et al., 2011). Nevertheless, we believe our findings have implications for other settings than NICUs, as discussed below.

## Practice Implications

Our results offer valuable implications for clinical units in general in hospitals, as well as for hospitals outside Germany. Clinical leadership is critical for an effective teamwork in these units, particularly in environments that face a high clinical uncertainty and complexity (e.g., Manser, 2009). Our findings provide valuable implications for practice by suggesting configurations among co-leaders as crucial factors for the management of interprofessional cooperation among team members. Furthermore, patient safety is an important issue in hospital units across disciplines and nations, placing the general emphasis on the identified relationship between co-leaders' shared goals, team cooperative norms, and safety climate. Drawing on our mediation model, hospitals striving to implement a safety climate should create a perception of common understanding and vision between the leading nurse and the leading physician. Strategies to achieve these aims may comprise leadership team training (Singer et al., 2011) that complements traditional team training approaches. In particular, joint development programs for leading nurses and physicians may have the potential to build a solid base for interprofessional co-leadership.

In closing, we would like to point out that cooperation among team members is a perpetual topic in health care practice and the related literature (e.g., Manser, 2009; Weller et al., 2014). Our results stress the importance for team norms that provide expectations about appropriate behavior for system members. Co-leaders should acknowledge their fundamental role in influencing these norms. Furthermore, the top management of hospitals should be aware of the high importance of middle management performed by nurse–physician co-leaders and the potential of these leadership dyads for interprofessional cooperation and, in turn, for patient safety.

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