

## **THE LINK BETWEEN TEAMWORK AND PATIENTS' OUTCOMES IN INTENSIVE CARE UNITS**

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- **BACKGROUND** *Links between teamwork and outcomes have been established in a number of fields. Investigations into this link in healthcare have yielded equivocal results.*
- **OBJECTIVE** *To examine the relationship between the level of self-identified teamwork in the intensive care unit and patients' outcomes.*
- **METHOD** *A total of 394 staff members of 17 intensive care units completed the Group Development Questionnaire and a demographic survey. The questionnaire is a reliable and valid measure of team development and effectiveness. Each unit's predicted and actual mortality rates for the month in which data were collected were obtained. Pearson product moment correlations and analyses of variance were used to analyze the data.*
- **RESULTS** *Staff members of units with mortality rates that were lower than predicted perceived their teams as functioning at higher stages of group development. They perceived their team members as less dependent and more trusting than did staff members of units with mortality rates that were higher than predicted. Staff members of high-performing units also perceived their teams as more structured and organized than did staff members of lower-performing units.*
- **CONCLUSIONS** *The results of this study and others establish a link between teamwork and patients' outcomes in intensive care units. The evidence is sufficient to warrant the implementation of strategies designed to improve the level of teamwork and collaboration among staff members in intensive care units. (American Journal of Critical Care. 2003;12:527-534)*

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The purpose of this study was to examine the relationship between the level of self-identified teamwork in the intensive care unit (ICU) and patients' outcomes. The link between teamwork and productivity has been established in many public, private, and nonprofit work settings.<sup>1-3</sup> However, the results of studies of the relationship between teamwork and patients' outcomes have been mixed. For example, some researchers<sup>4-8</sup> reported positive relationships between variables related to patients' outcomes and the level of collegiality, or teamwork, among staff members. On the other hand, others<sup>9-12</sup> concluded that the level of teamwork does not significantly influence patients' outcomes.

Previous research neither confirmed nor disconfirmed the existence of a link between teamwork and patients' outcomes. Possible reasons for these conflicting findings include the fact that most of these studies contained methodological and theoretical limitations. Small sample sizes and the use of subjective data and untested assessment instruments also may account for these equivocal results. Finally, most of these studies lacked a theoretical perspective and clear definitions of the constructs under investigation.

More research clearly is needed to determine whether a relationship exists between staff teamwork and patients' outcomes. Research that takes previous shortcomings into account by investigating this question with a larger sample, by using reliable and valid measures, and by providing clear definitions of terms that emanate from an established theoretical perspective is necessary. In this study, we attempted to meet all of these criteria.

### **Theoretical Perspective**

In the social science literature, levels of teamwork and productivity have been linked to the concept of group development.<sup>13</sup> The idea that groups develop across time has received wide acceptance among social scientists and practitioners for more than half a century. During that time, impressionistic studies, which relied on experiences and reflections of observers, and empirical studies that used observational systems were conducted.<sup>14-22</sup> The accumulated research evidence supports the general conclusion that groups move through successive stages that can be specifically demarcated and described.

Reviews<sup>13,23</sup> of research on group development supported the idea that groups move through 5 stages. The initial stage of development focuses on issues of inclusion and dependency; during this stage, members attempt to identify behavior acceptable to the leader and other group members.<sup>24</sup> This early stage also is characterized as a time when members are anxious.<sup>25</sup>

*Groups move through hierarchical stages of development.*

The next stage is described as a period of counterdependency and conflict.<sup>26-28</sup> During the second stage, issues of power, authority, and competition are debated. A number of theories<sup>29-31</sup> suggest that these early struggles regarding authority and status are pre-

requisites for subsequent increases in cohesion and cooperation. Confrontations with the leader establish solidarity and openness among members.<sup>32</sup> In addition, if conflicts are adequately resolved, member relationships with the leader and with each other become more trusting and cohesive.<sup>33-35</sup> This stage also provides the opportunity to clarify areas of common values, which increases the stability of the group.<sup>36</sup>

The third stage is devoted to the development of trust, increased collaboration and teamwork, and more mature and open negotiation about goals, roles, group structure, and division of labor.<sup>37,38</sup> The fourth, or work, stage is characterized by increases in group effectiveness and productivity. Groups that have a distinct ending point experience a fifth stage. Impending termination may cause disruption and conflict.<sup>39</sup> Increased expression of positive feelings also may occur, and separation issues are discussed.

Because of the preponderance of evidence for the existence of phases in group development, the research focus shifted to the investigation of the relationship between the level of development attained by work groups and the effectiveness and productivity of those groups. The results of these investigations confirmed a link between group development and productivity. Groups functioning at higher stages of development are more productive and more effective than groups at lower stages in accomplishing group goals.<sup>2,3,40</sup>

*Groups functioning at higher levels are more productive and achieve goals more effectively than groups functioning at lower levels.*

These studies were conducted in corporations, the service sector, and educational institutions by using a variety of measures of productivity, and the findings were consistent. The theory and research in this area suggest that findings would be similar in studies of staff groups in healthcare settings. Our study was designed to test that prediction. The study was intended to determine whether a relationship exists between the level of group development in ICU staff groups and patients' outcomes. Specifically, the following questions were addressed.

- Is there a relationship between certain individual or organizational demographic data in ICUs and staff members' perceptions of unit productivity?
- Is there a relationship between the level of group development in ICUs and patients' outcomes?

**Table 1** Scales of the Group Development Questionnaire and their corresponding stage of group development

Scale	Stage of group development
I	1, Dependency/inclusion
II	2, Counterdependency/fight
III	3, Trust/structure
IV	4, Work and productivity

## Method

Seventeen ICUs in 9 hospitals located on the east coast of the United States participated in this study. The total number of staff members who participated in the study from all 17 units was 394. Data collected included staff members' responses to the Group Development Questionnaire (GDQ) and a demographic survey. In addition, data were collected about the teaching status of the hospital (medical teaching vs nonteaching), the setting of the hospital (urban, community, or rural), and each unit's results on the Acute Physiology and Chronic Health Evaluation (APACHE) III<sup>41</sup> Mortality Prediction. The APACHE system is used to predict a patient's risk of dying in the hospital. The APACHE data were collected from 1 month's ICU admissions. Patients' medical records were reviewed to determine the standardized mortality ratio (SMR) for each unit.

## Setting and Sample

Because this was a field study of active work groups, a sample of ICUs that volunteered to participate was used. Approximately 50 hospitals were contacted and asked to participate.

## Data Collection

Permission to begin data collection was arranged with the ICU management team or the hospital's intensive care committee. Every hospital assigned 1 person as the facilitator for the data collection. This person was usually the APACHE III data coordinator in ICUs that used APACHE III or the nurse manager in ICUs that did not use APACHE III. Each participating hospital was visited for a 5-day period; each unit was visited several times in each 24-hour period to accommodate all possible shifts of workers. The data collector solicited participation from individual staff members as their time permitted during the normal workday. This practice was followed in order to be minimally intrusive with regard to patients' care. Staff members who agreed

**Table 2** Sample items contained in each scale of the Group Development Questionnaire

Scale	Sample items
I	Members tend to go along with whatever the leader suggests. There is very little conflict expressed in the group. We haven't discussed our goals very much.
II	People seem to have very different views about how things should be done in this group. Members challenge the leader's ideas. There is quite a bit of tension in the group at this time.
III	The group is spending its time planning how it will get its work done. We can rely on each other. We work as a team. The group is able to form subgroups, or subcommittees, to work on specific tasks.
IV	The group gets, gives, and uses feedback about its effectiveness and productivity. The group acts on its decisions. This group encourages high performance and quality work.

to participate were given a standard set of instructions about completing the demographic questionnaire and the GDQ. After the 5-day data collection period, either the APACHE III coordinator reported the SMR or the charts of patients admitted to the ICU were reviewed to determine the SMR for the month in which data collection occurred.

## Research Instruments

The GDQ and the Apache III SMR were used in this study for 2 reasons. First, both measures have demonstrated reliability and validity. Second, both measures have been used in similar studies.

Based on the Integrated Model of Group Development, the 60-item GDQ contains 4 scales that correspond to the first 4 stages of group development (Table 1). Each scale contains 15 items.

The items on scale I measure the amount of energy a group is expending in attempting to deal with issues of dependency and inclusion. Test questions were designed to detect the presence or absence of the characteristic behaviors of groups at this first stage of development. Questions on scale II seek to ascertain the degree of group focus on issues of conflict, counterdependency, and other characteristics associated with the second stage of development. The third scale assesses the degree of trust and structure that is pre-

**Table 3** Determining group stages of development on the basis of scores on the scales of the Group Development Questionnaire

Stage	Group Development Questionnaire scale			
	I	II	III	IV
1	>42	<42	<53	<56
2	<45	>46	<53	<56
3	<44	<40	54-58	57-62
4	<44	<40	>59	>63

sent in the group. Scale III is related to issues associated with the third stage of group development (trust). The characteristics of the fourth developmental stage (work) are assessed by using scale IV. Table 2 contains sample items from each GDQ scale.

Each item is scored from 1 (never true of this group) to 5 (always true of this group). Therefore, the minimum score on each scale is 15 and the maximum score is 75. An effectiveness ratio also is determined by dividing a team's actual mean score on GDQ scale IV by its potential maximum score (75). The minimum effectiveness ratio, then, is 20% and the maximum is 100%. A group's productivity mean represents the mean response to the question "In your opinion, how productive is this group?" Respondents rate the group from 1 (not productive at all) to 4 (very productive).

A group's overall stage of group development is determined by considering the mean scores of all 4 scales. During the first stage of group development, the mean score on GDQ scale I is at its highest, and scores on the other 3 scales are relatively low. During stage 2, the mean score on GDQ scale II is at its highest, and scores on the other 3 scales remain relatively low. At stage 3, mean scores on GDQ scales III and IV begin to increase, and mean scores on GDQ scales I and II decrease. Finally, at stage 4, mean scores on GDQ scales III and IV continue to increase, and mean scores on GDQ scale I and II remain low. Table 3 gives the range of scores on each GDQ scale for groups at different stages of development.

In order to ensure its reliability and validity, the GDQ has been subjected to a number of statistical tests.<sup>42</sup> Test-retest correlations, the internal consistency of each scale, and concurrent validity were explored. All correlations were highly significant. Criterion-related validity also was investigated. Work groups that ranked high on organizational measures of productivity had significantly higher scores on GDQ scales III and IV, the effectiveness ratio, and the productivity mean than did groups that ranked low on

these external productivity measures. Likewise, groups ranked high on organizational measures of productivity had significantly lower scores on GDQ scales I and II. Thus, work groups at higher stages of development were more effective and productive.<sup>2,3,40</sup>

The APACHE III system can be used to predict a patient's risk of dying in the ICU.<sup>43</sup> A patient's medical profile is compared with thousands of cases before a prognosis is reached. APACHE III predictions are very accurate and make it possible to evaluate the effectiveness of the ICU. The APACHE III-derived predicted mortality rate for each patient is used to determine the unit's SMR. Individual scores are averaged to determine the unit's predicted mortality rate. Dividing each unit's actual mortality rate by the predicted mortality rate provides the unit's SMR. An SMR of 1 indicates that the actual death rates and the predicted death rates are the same. An SMR less than 1 indicates that the actual death rate is lower than predicted, and an SMR greater than 1 indicates that the actual death rate is higher than predicted. Thus, a lower than predicted SMR means that more patients than expected, on the basis of their risk factors, survived.

The APACHE instrument has been used previously in similar studies as an indicator of a unit's effectiveness and the quality of care provided by that unit.<sup>4,5,44</sup> Although some researchers have questioned the use of the SMR as a quality measure in ICUs, few measures of patients' outcomes have been as thoroughly tested as APACHE III.<sup>44,45</sup>

## Results

### Description of the Sample

Nine hospitals in which both administrators and institutional review boards agreed to participate were included in the study. Participating hospitals were as far north as Connecticut and as far south as Florida. Of the 17 ICUs, 12 used the APACHE III system. Five of the hospitals were medical training hospitals staffed with both resident and attending physicians. Only 1 hospital was rural; 5 were community based, and 3 were urban.

Participants' responses to the demographic survey are reported next. Most participants (75%) were registered nurses. The remaining 25% was almost equally divided among other categories of healthcare workers (physicians, unit clerks, and unlicensed assistive personnel). Only 4 licensed practical/vocational nurses participated in the study. Licensed practical nurses are not typically employed in ICUs because of practice limitations.

Most participants (80%) were women, and 70% of participants were between 20 and 40 years old. A

**Table 4** Intercorrelations for staff age, occupational tenure, and staff members' perceptions of unit conflict and productivity

Variable	Conflict	Unit productivity
Age	0.098	0.112*
Occupational tenure	0.111*	0.053

\* $P = .05$ .

total of 74% of the participants were white; the remaining 26% were split about evenly between Hispanic Americans, Native Americans, African Americans/Non-Hispanic, and other.

The majority (42%) of participants had completed a bachelor's degree, and 31% held an associate's degree. Eighteen nurses (5%) had master's degrees. Thirty-five physicians participated (9%). Thirty-nine participants (10%) had either a high school diploma or a trade school diploma.

*Intensive care units showing higher levels of group development have lower mortality rates than predicted.*

The mean time that participants had been employed by their respective hospitals was 16.6 years, with a mean of 12 of those years in the ICU. The mean time that participants had been employed in their current occupation was 24 years. Because ICUs operate around the clock, participants were asked to indicate the shift on which they spend the majority of their work time; a total of 250 worked the day shift, 108 worked the night shift, and 36 worked the evening shift.

#### Relationship Between Certain Individual or Organizational Demographic Data in ICUs and Staff Members' Perceptions of Unit Productivity

Pearson product moment correlations and analyses of variance were used to determine if a relationship existed between certain individual or organizational demographic data in ICUs and staff members' perceptions of unit productivity. Of the 13 demographic variables, only 3 were significant. Education was significant in relation to GDQ scale II ( $F = 3.113$ ,  $df = 6,377$ ,  $P = .005$ ). Post hoc analyses revealed that the 18 nurses who held masters' degrees perceived

**Table 5** Intercorrelations for number of respondents, standardized mortality ratio (SMR), and developmental stage

Variable	Respondents	SMR	Stage
Respondents	1.00	0.164	0.246
SMR	0.164	1.00	-0.662*
Stage	0.246	-0.662*	1.00

\* $P = .01$ .

significantly more conflict in their various units than did other staff members.

Occupational tenure correlated with perceptions of conflict. Participants who had been in their respective professions longer tended to view their staff groups as engaging in more conflict with unit leaders and other staff members. Also, older staff members tended to view their staff groups as more productive (Table 4).

#### Relationship Between the Level of Group Development in ICUs and Patients' Outcomes

Data were collected to determine each unit's SMR. Units that used the APACHE III Mortality Prediction Model provided the SMR for the month of data collection. Units that did not use the APACHE III Mortality Prediction Model allowed a chart review of 1 month's ICU admissions to determine each patient's predicted mortality. The mean of these values was used to create the unit's mean predicted mortality. Data on patients' mortality for that month also were gathered from the chart review.

Traditionally, research on groups requires statistical analyses on the group level as well as the individual level. We did analyses at both levels.

#### Group Level Analyses

In order to ensure that results were not due to the unequal numbers of staff members who participated in the study in the 17 units, the number of participants in each unit was correlated with that unit's SMR and stage of group development. No significant correlations were noted. A significant correlation ( $r = -0.662$ ,  $P = .004$ ) was noted, however, between a unit's stage of group development and that unit's SMR. As staff members' perceptions of their level of group development increased, SMR decreased. That is, as stage of group development increased, fewer deaths occurred than had been predicted (Table 5).

In order to explore this finding in more depth, the 17 ICUs were divided into 3 subgroups on the basis of the naturally occurring gaps in the SMR results for



**Table 6** Classification of intensive care units (ICUs) by standardized mortality ratio (SMR)

	ICU	No. of		SMR	Stage
		ICU	respondents		
Low SMR/ high performing	1	14	0.134	3	
	2	14	0.154	3	
	3	23	0.207	3	
	4	13	0.36	2	
	5	35	0.424	2	
	6	31	0.619	3	
Middle SMR/middle performing	7	10	0.66	2	
	8	48	0.68	3	
	9	19	0.69	3	
	10	35	0.72	2	
	11	16	0.81	2	
High SMR/low performing	12	12	0.88	1	
	13	25	0.88	2	
	14	28	0.88	2	
	15	12	0.98	2	
	16	43	1.34	2	
	17	16	1.40	1	

the various units (Table 6): low-SMR/high-performing, middle-SMR/middle-performing, and high-SMR/low-performing groups. Analyses of variance revealed significant differences in the SMR results of the units within each subgroup (Table 7). In addition, the mean stage of group development within each subgroup differed significantly from the mean stage in the other 2 subgroups (Table 8). That is, staff members of ICUs with low SMR rates perceived their staff group as functioning at higher stages of group development than did staff members of ICUs with midrange or high SMRs.

#### Individual Level Analyses

Analyses of variance revealed significant differences among the 3 subgroups on 3 of the 4 GDQ scales and group stage (Table 9). On GDQ scale I, staff members of low-SMR/high-performing ICUs perceived their staff groups as significantly less dependent than did members of middle-SMR/middle-performing ICUs and high-SMR/low-performing ICUs. No significant difference was noted between middle-SMR/middle-performing ICUs and high-SMR/low-performing ICUs on this scale.

On GDQ scale II, staff members of low-SMR/high-performing ICUs perceived their staff groups as less engaged in conflict with authority figures and other members than did members of middle-SMR/middle-performing ICUs and high-SMR/low-performing ICUs. No significant difference was noted between

**Table 7** Analysis of variance for standardized mortality ratio (SMR) and stage of development in low-SMR/high-performing vs middle-SMR/middle-performing vs high-SMR/low-performing intensive care units

Variable	Sum of squares	df	Mean square	F	P
<b>Stage</b>					
Between groups	3.192	2	1.596	5.779	.015
Within groups	3.867	14	0.276		
Total	7.059	16			
<b>SMR</b>					
Between groups	1.661	2	0.831	23.821	.001
Within groups	0.488	14	3.487 x 10 <sup>-2</sup>		
Total	2.149	16			

middle-SMR/middle-performing ICUs and high-SMR/low-performing ICUs on this scale.

On GDQ scale III, staff members of low-SMR/high-performing and middle-SMR/middle-performing ICUs perceived their staff groups as more organized and staff members as more trusting of each other than did members of high-SMR/low-performing ICUs. No significant difference was noted between low-SMR/high-performing ICUs and middle-SMR/middle-performing ICUs on this scale.

Finally, staff members of low-SMR/high-performing and middle-SMR/middle-performing ICUs perceived their staff groups as functioning at higher levels of group development than did members of high-SMR/low-performing ICUs. No significant difference was noted between low-SMR/high-performing ICUs and middle-SMR/middle-performing ICUs on this variable.

#### Discussion

Our results suggest the following conclusions. First, demographic data has little bearing on members' perceptions of their staff group's development or productivity. This finding is consistent with the findings of other studies.<sup>2,3,40</sup>

Second, individuals in low-SMR/high-performing ICUs perceived their staff groups as functioning at higher levels of development than did individuals in middle-SMR/middle-performing ICUs or high-SMR/low-performing ICUs. A link between teamwork and patients' outcomes is established by these results.

These findings lend support to those of a number of previous researchers.<sup>5,7,8</sup> The weight of evidence for the validity of a link between teamwork and outcomes for ICU patients is mounting. Although more research is needed to confirm these results, it may be time to consider ways to improve the level of teamwork and collaboration among staffs in the ICU. Other factors

**Table 8** Mean developmental stage and standardized mortality ratio (SMR) for low-SMR/high-performing, middle-SMR/middle-performing, and high-SMR/low-performing intensive care units

Type of intensive care unit	SMR	Stage
Low-SMR/high-performing	0.32	2.7
Middle-SMR/middle-performing	0.72	2.4
High-SMR/low-performing	1.10	1.7

doubtless contribute to patients' outcomes as well. However, on the basis of these results, it seems advisable to consider ways to improve the level of teamwork in the ICU and in healthcare in general.<sup>46</sup>

Currently, the preparation of physicians, nurses, and support personnel does not include sufficient emphasis on teamwork and teamwork skills. The healthcare industry and its consumers would benefit from revised curricula with increased emphasis on these important skills. In-service training for all healthcare employees also would be helpful.

Also, in many industries, teams have access to professional consultants when team problems emerge. Although a small number of healthcare settings have this option, help with team problems is not readily available in most healthcare settings. A number of intervention strategies designed to increase teamwork and collaboration have had beneficial results.<sup>47,48</sup> Access to such strategies could improve not only patients' outcomes but also the quality of work life for healthcare professionals. Good outcomes for patients and a high quality of work life for healthcare professionals are core goals of the healthcare industry and are inextricably linked. Increasing efforts to create supportive, productive healthcare teams may help the industry to reach both these goals.

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**Table 9** Analysis of variance for scales of the Group Development Questionnaire (GDQ) and stage of development in low-standardized mortality ratio (SMR)/high-performing vs middle-SMR/middle-performing vs high-SMR/low-performing intensive care units

GDQ scale	Sum of squares	df	Mean	F	P
I					
Between groups	251.767	2	125.883	5.542	.004
Within groups	8653.973	381	22.714		
Total	8905.740	383			
II					
Between groups	680.010	2	340.005	5.445	.005
Within groups	23788.949	381	62.438		
Total	24468.958	383			
III					
Between groups	382.319	2	191.159	4.034	.02
Within groups	18054.908	381	47.388		
Total	18437.227	383			
IV					
Between groups	179.199	2	89.600	1.453	.24
Within groups	23497.290	381	61.673		
Total	23676.490	383			
Stage					
Between groups	54.770	2	27.385	124.059	.001
Within groups	84.103	381	.221		
Total	138.872	383			

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