

Interprofessional Teamwork Reduces Medical Errors and Burnout

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Abstract

How can psychological intervention and network intervention improve intergroup relations? We argue that behavioral change and structural change are seed and soil and work best when they are integrated. We ran a field experiment to improve nurse-doctor collaboration. Baseline surveys showed that nurses were more likely to share information with their peers rather than with doctors, missing the opportunity to correct diagnostic errors. To mitigate both psychological and structural barriers to interprofessional teamwork, 519 medical teams in 5 hospitals (1,082 nurses, 847 doctors) were randomly assigned to a values-affirmation intervention for nurses; a weekly multidisciplinary round involving doctors and nurses; both interventions back-to-back; or a control group. We measured diagnostic errors using state-audited electronic medical records and burnout using the MBI scale over 4 months. To explore mechanisms, we traced interprofessional information sharing and emotional support through experience sampling over 10 days. We found that either intervention significantly reduced doctors' medical errors through nurses' information sharing and nurse burnout through doctors' emotional support; larger reductions were observed with the interventions conducted back-to-back. Manipulation checks showed that nurses were less anxious about the multidisciplinary round and spoke up more during the round after receiving the affirmation intervention. We also found that the intervention effect on information sharing was larger when the baseline psychological safety of teams was higher and that the emotional support effect on burnout was larger when nurses' baseline sense of belonging was lower. Overall, we identified the organizational contingencies of a widely used psychological intervention and evidence the complementary effects of individual change and social change efforts on improving intergroup relations in the workplace.

Keywords: Interprofessional teamwork; medical errors; nurse burnout; multidisciplinary round; self-affirmation; social support; psychological safety; social belonging; social psychological intervention; network intervention

1.Introduction

Medical error is one of the leading causes of death in the U.S. (Pham et al., 2012). The Institute of Medicine (2007) pointed out that “to err is human.” A recent study found

that a 10% increase in incivility against team members, possibly due to fault lines between healthcare professionals of divergent backgrounds, is associated with 8.87% more hospital-acquired infections (a type of medical error) and 10.59% higher mortality (Li, Choi, and Gelfand, 2023).

Of particular importance to medical error reduction is interprofessional teamwork between nurses and doctors (Rosen et al., 2018). Nurses understand patients' conditions and needs from frequent interactions with them, but doctors have the authority to make medical decisions. Thus, without sufficient input from nurses, doctors could make a wrong decision or fail to promptly correct it (Centola et al., 2023). At the same time, low emotional support from doctors could increase nurse burnout, creating a vicious circle between burnout and errors.

Nurses do not always share critical patient information with physicians because they do not have an opportunity to do so or because doing so may pose a threat to their self-integrity. A study found that nurses tended to interact more with fellow nurses rather than with physicians due to their focus on care routines and the fear of being perceived as incompetent (Tucker and Edmondson, 2003). These observations align with our surveys on Chinese doctors, in which we found a low frequency of information sharing from nurses to doctors in the same medical teams, though the surveyed teams with more information sharing reported fewer diagnostic errors.

Currently, the Agency for Healthcare Research and Quality recommends TeamSTEPPS training to improve interprofessional collaboration and communication. The training lasts nearly two months and costs from \$400 to \$900 per participant (King et al., 2008), making it hard to implement in resource-scarce settings. In the present study, we tested two brief and affordable interventions that may address the psychological and structural barriers to interprofessional teamwork.

Self-affirmation is a widely used social psychological intervention (Cohen, 2006) that could reduce the threat to nurses' self-integrity when they reach out to doctors to discuss patients. Once affirmed, nurses may feel less threatened and worry less about being perceived as incompetent when they work interdependently with doctors. Previous research has shown that self-affirmation (writing important values) increases disadvantaged students' science grades and fosters their social networks (Turetsky et al., 2020). However, it remains unclear whether values affirmation can improve intergroup relations, as well as team performance and well-being in the workplace.

Hypothesis 1a: Self-affirmation intervention reduces medical errors.

Hypothesis 2a: Self-affirmation intervention reduces nurse burnout.

Multidisciplinary rounds (MDR) create a structural opportunity for nurses and doctors to be in contact with each other and collaborate on patient care, thus can be considered a network intervention (Valente, 2012). Traditionally, doctors routinely visit

patients to make diagnoses and treatment plans with little involvement from nurses. Research has shown that involving other healthcare professionals, such as pharmacists, in rounds can improve information sharing and reduce medical errors (Leape et al., 1999). However, we lack causal evidence on the effect of doctor-nurse MDR on medical errors and clinician well-being (Curley et al., 1998).

Hypothesis 1b: Multidisciplinary round intervention reduces medical errors.

Hypothesis 2b: Multidisciplinary round intervention reduces nurse burnout.

Moreover, MDR alone may not suffice to increase nurses' information sharing with doctors if psychological barriers exist for the nurses. Similarly, self-affirmation for nurses may not fully improve information sharing if they do not have appropriate timing and space to do so. Thus, the effects of values affirmation and MDR may be complementary, especially when nurses are first motivated by values affirmation to share information and then enabled by MDR to do so. Such a combination could trigger a positive feedback loop in nurses' perceptions of self-integrity and their information-sharing behavior (Creswell et al., 2013).

Hypothesis 1c: A combined intervention of self-affirmation and multidisciplinary round reduces medical errors more than self-affirmation or multidisciplinary round alone does.

Hypothesis 2c: A combined intervention of self-affirmation and multidisciplinary round reduces nurse burnout more than self-affirmation or multidisciplinary round alone does.

We also argue that as information sharing increases and intergroup relations improve, doctors will also value nurses more as teammates and offer more emotional support, which will reduce nurse burnout (Reiff et al., 2022).

Hypothesis 3a: The effects in Hypothesis 1 are mediated through information sharing from nurses to doctors.

Hypothesis 3b: The effects in Hypothesis 2 are mediated through emotional support from doctors to nurses.

2. Methodology

Setting and Participants. The management of 5 tertiary hospitals in Eastern China implemented the program in all medical teams, except for the teams that did not independently treat patients (e.g., pathologists and anesthesiologists). Healthcare staff were not paid to participate in the program. The region had a medium level of socioeconomic development in China, and the hospitals had between 200 and 750 beds.

We conservatively estimated a power of 0.946 with 480 medical teams. A total of 519 medical teams were recruited, consisting of 847 doctors (including 328 residents)

and 1,082 nurses. The teams had 2 to 9 staff members, with a mean of 3.72. The characteristics of the participants are presented in Table 1 below.

Table 1. Descriptive Statistics

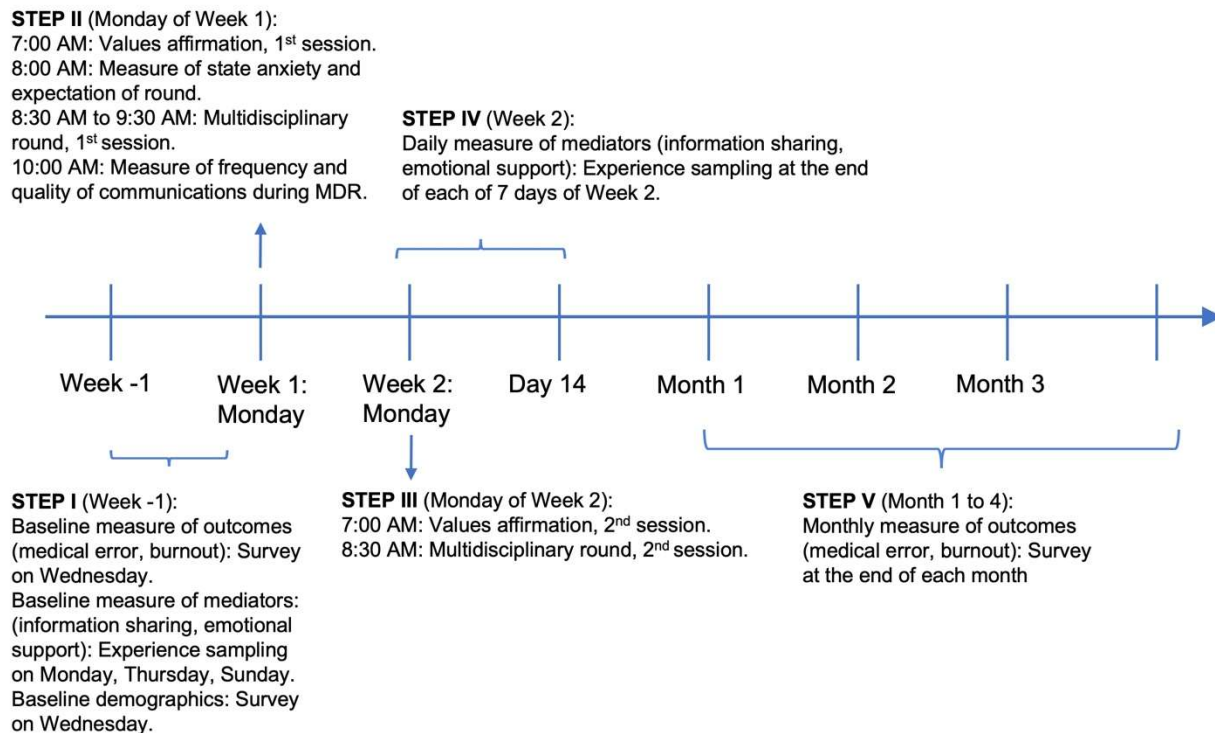
	Doctors , median or %	Nurses, median or %	χ^2
Participant characteristics			
Age, median	40-44	35-39	$p<0.001$
Female, %	41.20	95.56	$p<0.001$
Ethnic minority, %	1.06	1.57	$p=0.336$
Marital status, %			
Married	61.04	56.19	$p=0.032$
Number of children, %			
No child	41.56	48.89	
One child	45.57	39.28	
Two or more children	12.87	11.83	
Educational level, %			$p<0.001$
High school or below	0	0.18	
Technical/vocational school	2.95	10.91	
Associate degree	11.81	35.30	
Bachelor's degree ^a	51.00	51.48	
Master's degree	29.63	2.13	
Doctoral degree	4.60	0	
Party membership, %			$p<0.001$
Member	32.35	6.84	
Clinical specialty, %			$P=0.315$
Internal medicine	48.76	44.36	
Surgery	30.46	35.30	
Emergency medicine	6.73	6.28	
Obstetrics and gynecology	5.79	6.56	
Pediatrics	4.01	4.16	
Radiology	2.24	1.76	

Traditional Chinese medicine	2.01	1.57	
Professional grade, %			$p<0.001$
No grade	0.71	7.95	
Resident/Nurse	36.48	41.77	
Attending/Supervisor	42.74	47.41	
nurse			
Associate professor	15.11	2.68	
Professor	4.96	0.18	
Managerial position, %			$p<0.001$
Administrator	26.21	0	
Tenure, median	10-14	10-14	$p<0.001$
Weekly work hours, %			$p<0.001$
<40	7.79	11.46	
40-44	13.70	23.20	
45-49	19.24	29.02	
50-54	18.30	23.01	
55-59	18.42	9.61	
60-64	13.58	3.42	
65-69	6.61	0.28	
≥ 70	2.36	0	
Monthly income, %			$p<0.001$
¥5,001-¥7,500	0	2.77	
¥7,501-¥10,000	0.47	12.01	
¥10,001-¥15,000	19.01	56.10	
¥15,001-¥20,000	49.11	26.52	
¥20,001-¥30,000	28.57	2.59	
¥30,001-¥50,000	2.83	0	
Burnout, M		65.25	
(SD)		(25.67)	
Number of participants	847	1,082	

Experimental Design. Using a computer-generated random number for each of the 519 medical teams, we conducted clustered randomization. We randomly assigned teams to one of four experimental conditions, based on a 2×2 factorial design: no self-affirmation and no MDR, values-affirmation and no MDR, MDR and no values-affirmation, and MDR and values-affirmation. We ensured double blindness by using

separate experimental staff for each condition (see Appendix A3). The experimental timeline is described in Figure 1 below.

Figure 1. Experimental Timeline.



Values-affirmation Intervention. Nurses in treatment and control groups were invited to two different conference rooms. Nurses in the treatment group circled two or three values that were important to them from a list, thought about when these values were important, and wrote about why they were important (Cohen et al., 2006). Nurses in the control group circled two or three values that were not important to them from a list, thought about when these values were important to other people, and wrote about why they were important to other people (see Appendices A1 and A2). The same procedures were repeated on Monday mornings of two consecutive weeks for reinforcement. These procedures were designed based on a pre-registered pretest (AsPredicted 176868).

Multidisciplinary Round Intervention. In MDR, nurses rounded on patients with doctors (Curley et al., 1998) after values-affirmation on two consecutive Monday mornings. In the control group, nurses and doctors rounded on patients independently as usual after values-affirmation. We designed MDR based on a systematic review of past interventions (PROSPERO 2024 CRD42024563983) and a pre-registered pretest (AsPredicted 176868), including effective elements such as pre-round training, checklist, and post-round huddle.

Manipulation Checks. Manipulation checks on values-affirmation were conducted immediately after the values-affirmation intervention (including the control group) but immediately before MDR (if applicable). They consisted of questions regarding whether nurses felt anxious at that moment (the State-Trait Anxiety Inventory, Spielberger et al., 1983) and whether they looked forward to the round. Manipulation checks on MDR were conducted immediately after MDR. They consisted of nurse-reported frequency of communications and quality of communications (Iowa Communication Record; Duck et al., 1991) between nurses and doctors during MDR. All measures are presented in Appendix A4.

Variables and Measures. The primary outcome is *medical errors*, specifically diagnostic errors, recorded in the state-audited electronic medical records. Following scholarly consensus and standard hospital practices, medical errors were measured at the team level and were not attributed to individual clinicians. According to the criterion set by the National Health Commission (2016), diagnostic error was defined as a difference in the first four digits of ICD-10 codes between the preliminary diagnosis and the discharge diagnosis. The monthly medical error rate is thus calculated as:

$$\frac{\text{number of code differences}}{\text{total number of discharges}} \times 100\% .$$

A secondary outcome is nurse *burnout*, measured by the 22-item Maslach Burnout Inventory (MBI-HSS-MP) (Maslach et al., 1997). We defined outcome change as the difference between the baseline measure and the first monthly measure after the intervention.

The mediator for doctors’ medical errors is nurses’ *information sharing* to doctors in the same team (Centola et al., 2023), and the mediator for nurse burnout is doctors’ *emotional support* to nurses in their team (Reiff et al., 2022). Both mediators were measured using the experience sampling method. Participants were prompted to answer two questions before leaving work on each of the 7 days following the self-affirmation intervention: “How many times did you reach out to doctors/residents in your team to discuss your patients today?” and “How many times did you receive emotional support from doctors/residents in your team today?” The baseline for these mediators was measured on Monday, Thursday, and Sunday of the week before the intervention. We took the mean of the three baseline waves as the pre-measure, the mean of the seven waves after the intervention as the post-measure. We calculated the mediator as the post-measure minus the pre-measure. Because medical errors were measured at the team level, we took the arithmetic mean of information sharing within the team.

The moderators are team-level *psychological safety* for information sharing and participants’ sense of *social belonging* for emotional support, both measured with

validated scales (Edmondson, 1999; Walton and Cohen, 2007; 2011; Appendix A4) before the intervention. We also took the team arithmetic mean of psychological safety.

As for control variables in robustness analyses, we collected team-level participants' characteristics, including age, ethnicity, highest education, professional grade, managerial position, clinical specialty, weekly work hours, monthly personal income, political ideology, marital status, and number of children. We also collected data on team size and structure and the hospital's characteristics. These variables are described in Table 1 above.

Analyses. We will first compare the mean outcome changes between any two conditions. We will then perform mediation analyses using structural equation models. We used hierarchical linear models for multilevel burnout outcome. Finally, we will conduct pre-specified subgroup analyses with interaction terms. Statistical significance will be defined as a p -value < 0.05 using two-tailed tests.

Logistics. Stanford University's Institutional Review Board waived the study from ethical approval because no identifiable human subjects were involved. We pre-registered the study on the OSF Registry: <https://osf.io/xktdu>.

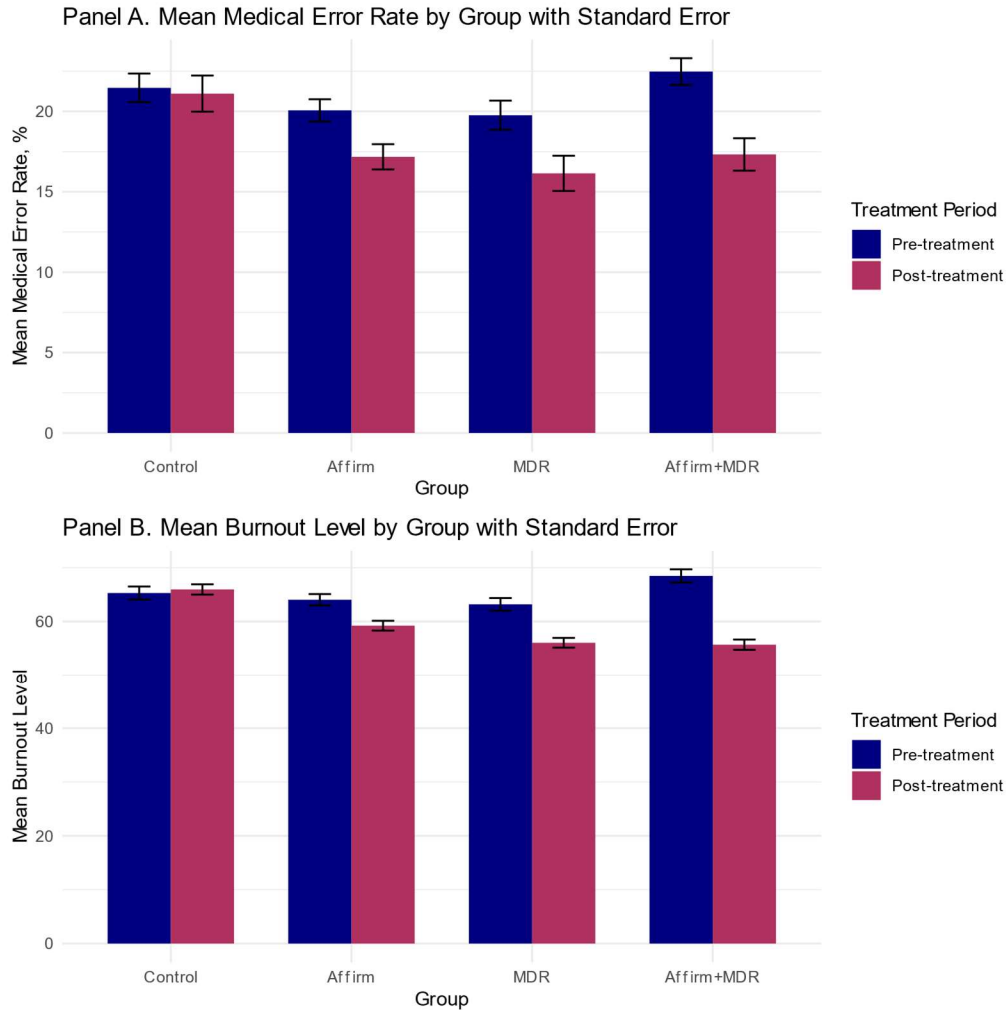
3. Results.

Main Effects. Panel A of Figure 2 below shows the baseline medical error rate and medical error rate one month after the intervention. Affirmation, multidisciplinary round (MDR), and the combined intervention of affirmation and MDR all reduced medical errors. Specifically, affirmation reduced medical errors by 14.39% or 0.34 standardized mean difference (Cohen's d); MDR reduced medical errors by 18.29% or 0.31 Cohen's d , and the combined intervention reduced medical errors by 22.94% or 0.49 Cohen's d .

Panel B of Figure 2 below shows the baseline nurse burnout level and burnout level one month after the intervention. Affirmation, MDR, and the combined intervention of affirmation and MDR all reduced burnout level. Specifically, affirmation reduced burnout by 7.52% or 0.22 Cohen's d ; MDR reduced burnout by 11.31% or 0.31 Cohen's d , and the combined intervention reduced burnout by 18.68% or 0.54 Cohen's d .

Notably, the combined intervention of affirmation and MDR reduced more medical errors more than affirmation alone ($B=-0.02$, $SE=0.01$, $t=-2.85$, $P=0.001$) or MDR alone ($B=-0.015$, $SE=0.01$, $t=-1.62$, $P=0.106$). The combined intervention of affirmation and MDR also reduced more burnout than either affirmation alone ($B=-7.98$, $SE=2.05$, $t=-3.88$, $P<0.01$) or MDR alone ($B=-5.65$, $SE=2.16$, $t=-2.62$, $P<0.01$).

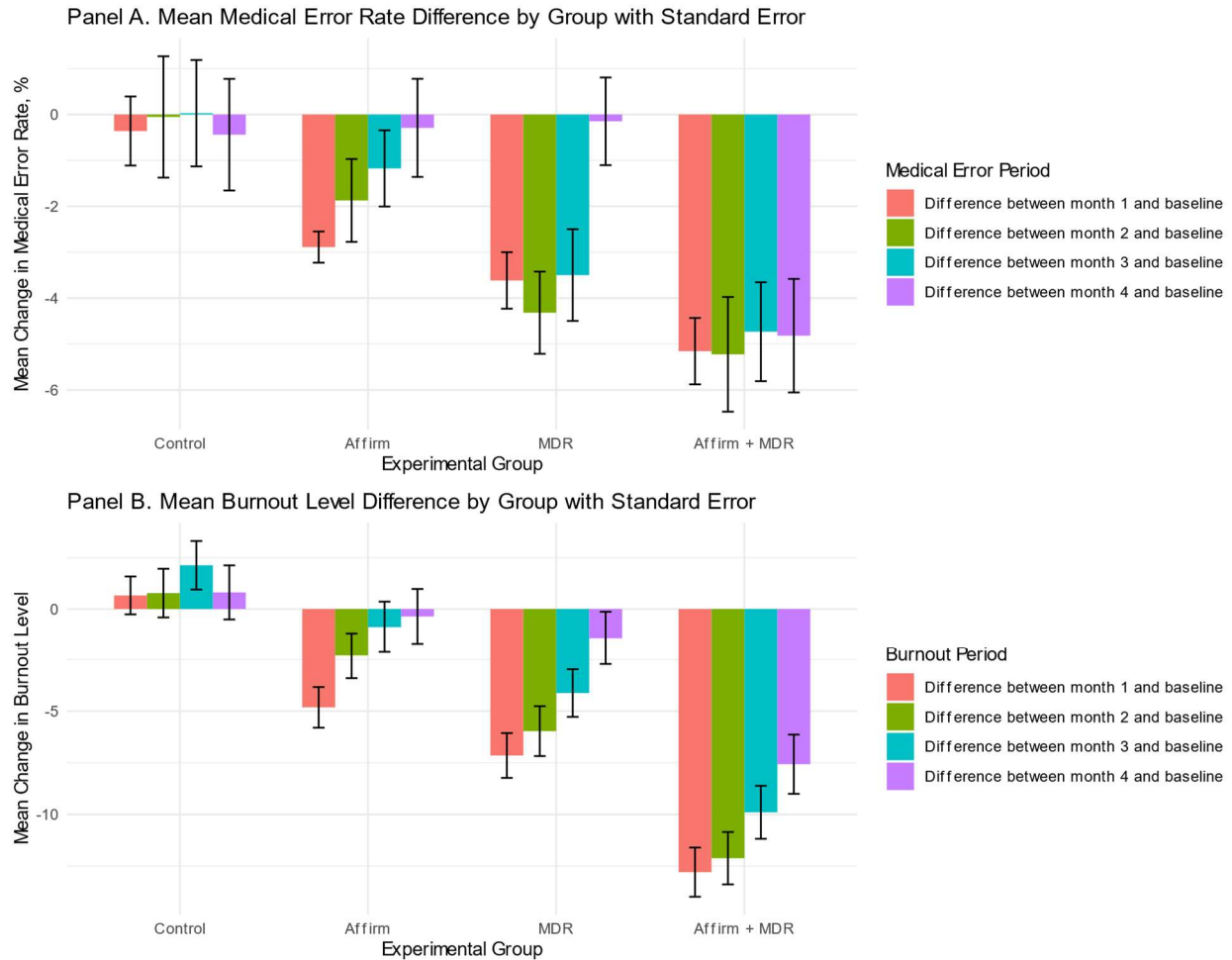
Figure 2: Baseline and Post-Intervention Medical Errors and Burnout by Conditions



Sustainability of Effects. Figure 3 below shows that the intervention effects attenuated over the four-month follow-up period; however, the sustainability of effects differed by conditions. In Panel A, affirmation's effect on medical errors lasted only 1 month (month 1, $B=-0.03$, $SE=0.008$, $t=-3.06$, $P<0.01$; month 2, $B=-0.018$, $SE=0.02$, $t=-1.14$, $P=0.26$); MDR's effect on medical errors lasted 3 months (month 3, $B=-0.04$, $SE=0.02$, $t=-2.31$, $P=0.02$; month 4, $B=0.003$, $SE=0.02$, $t=0.19$, $P=0.851$); and the combined intervention's effect on medical errors lasted at least 4 months (month 4, $B=-0.04$, $SE=0.017$, $t=-2.53$, $P=0.01$).

Similarly, in Panel B, affirmation's effect on burnout lasted 1 months (month 1, $B=-5.48$, $SE=1.79$, $t=-3.06$, $P=0.002$; month 2, $B=-3.07$, $SE=2.17$, $t=-1.41$, $P=0.16$); MDR's effect on burnout sustained over 3 months (month 3, $B=-6.25$, $SE=2.25$, $t=-2.78$, $P=0.006$; month 4, $B=-2.23$, $SE=2.52$, $t=-0.89$, $P=0.38$); and the combined intervention's effect on burnout lasted at least 4 months (month 4, $B=-8.38$, $SE=2.62$, $t=-3.19$, $P<0.01$).

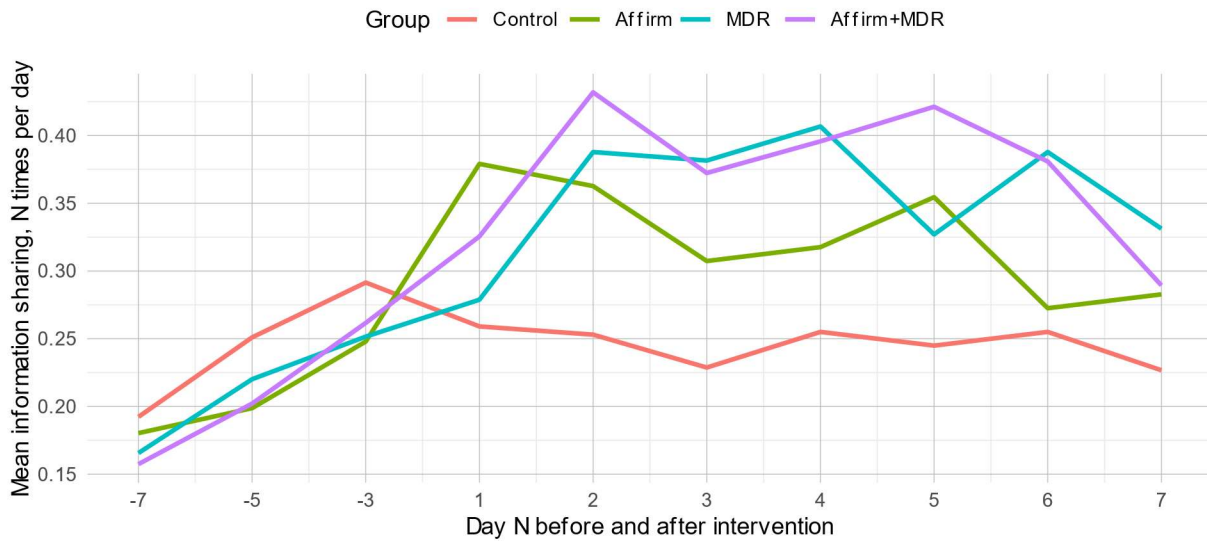
Figure 3. Intervention Effects Over Time.



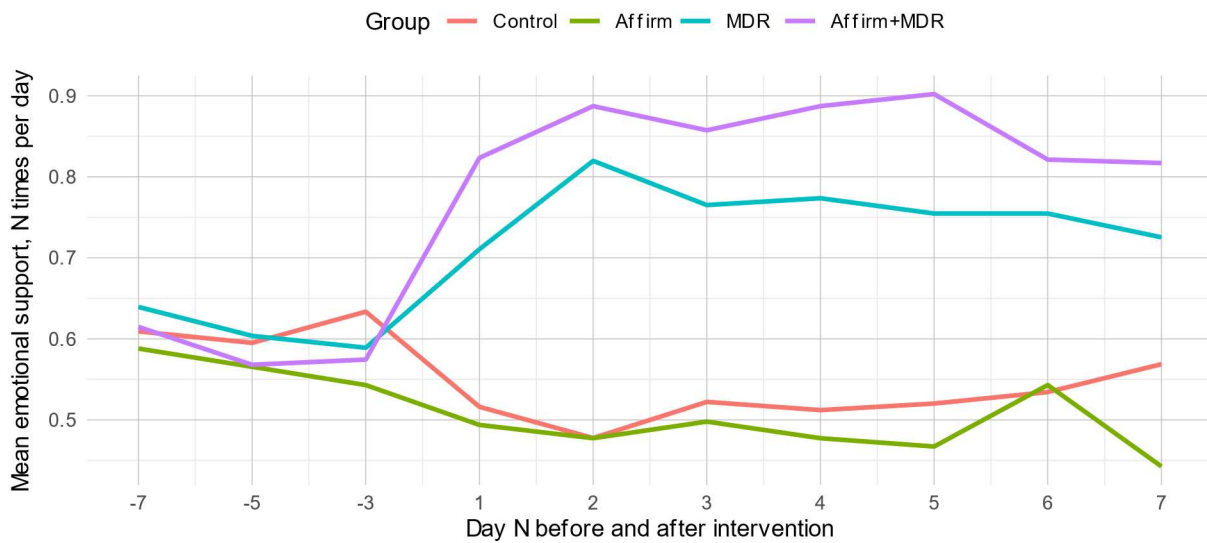
Mechanisms for Main Effects. We explored the mechanisms of why interventions reduced medical errors and burnout. Panel A of Figure 4 below shows that interventions significantly increased information sharing from nurses to doctors, by 0.44 Cohen's d for affirmation, by 0.58 Cohen's d for MDR, and by 0.61 Cohen's d for the combined intervention. Mediation analyses in Panel A of Figure 5 show that increases in information sharing significantly mediated reductions in medical errors in each condition.

Figure 4. Experience Sampling of Teamwork Behaviors

Panel A. Information Sharing from Nurse to Doctor Before and After Intervention



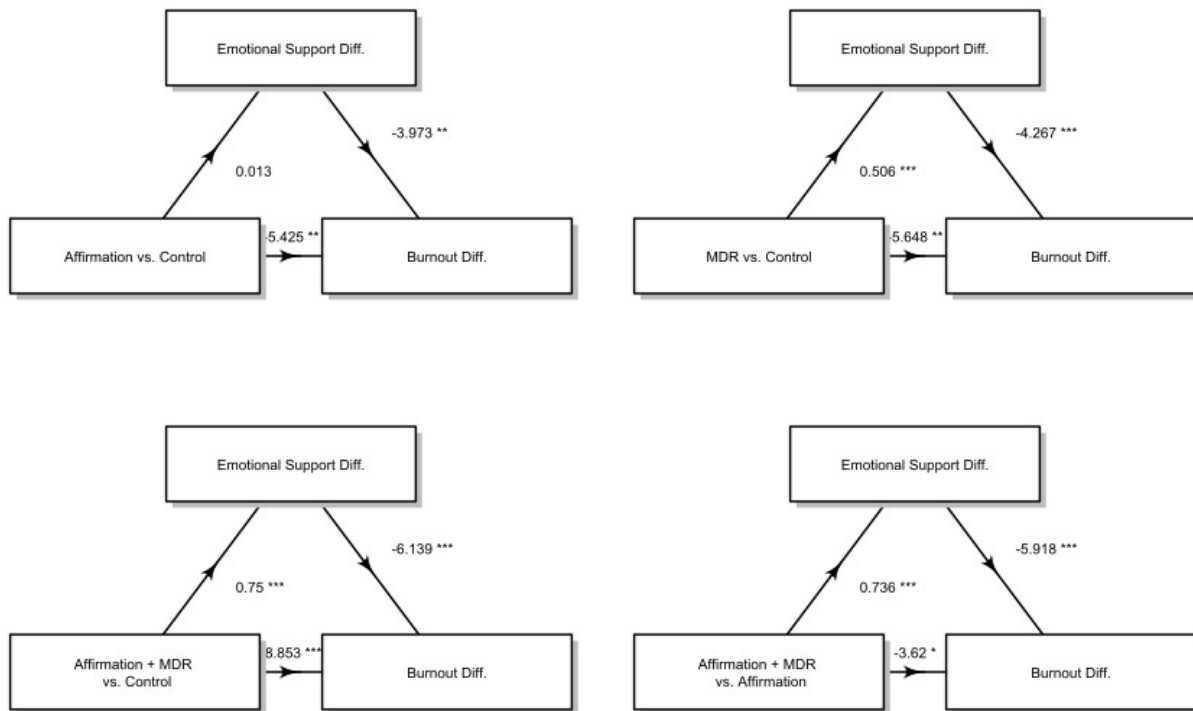
Panel B. Emotional Support from Doctor to Nurse Before and After Intervention



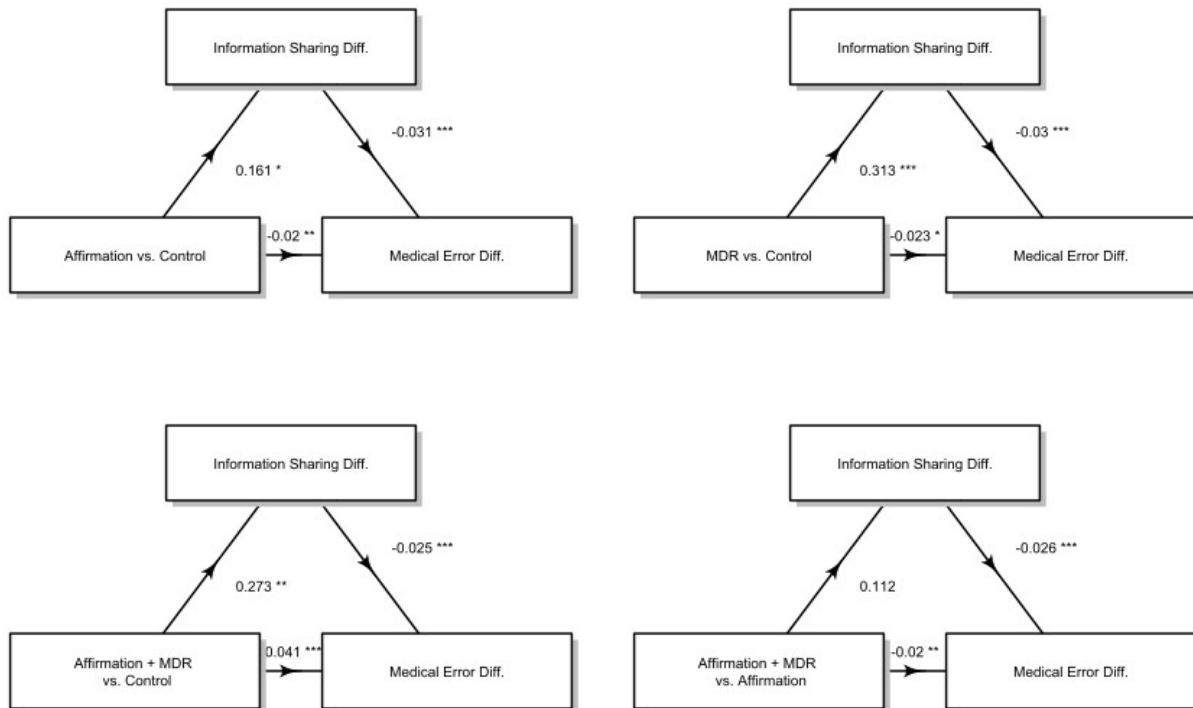
Panel B of Figure 4 below shows that interventions significantly increased emotional support from doctors to nurses, by 0.008 Cohen's d for affirmation (not statistically significant), by 0.55 Cohen's d for MDR, and by 0.88 Cohen's d for the combined intervention. Mediation analyses in Panel B of Figure 5 show that increases in emotional support significantly mediated reductions in burnout in each condition. Overall, the reductions in medical errors and burnout could be attributed to improved interprofessional communication and collaboration after interventions.

Figure 5. Mediation by Teamwork Behaviors

Panel A.



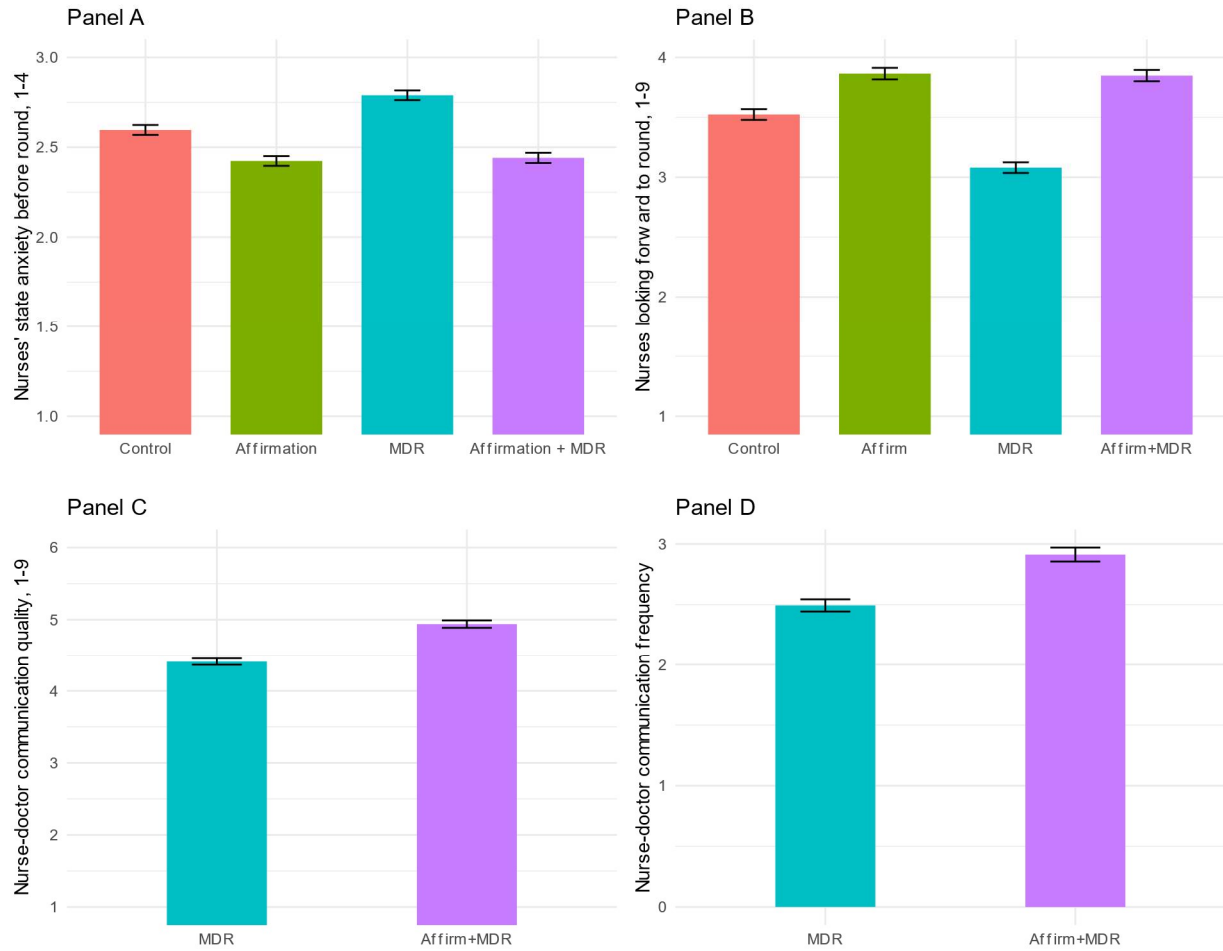
Panel B.



Mechanisms for Synergy. Notice in Figure 3 above that the combined intervention increased information sharing and emotional support more than affirmation or MDR alone, which likely explained the larger and more sustainable effects of the combined intervention.

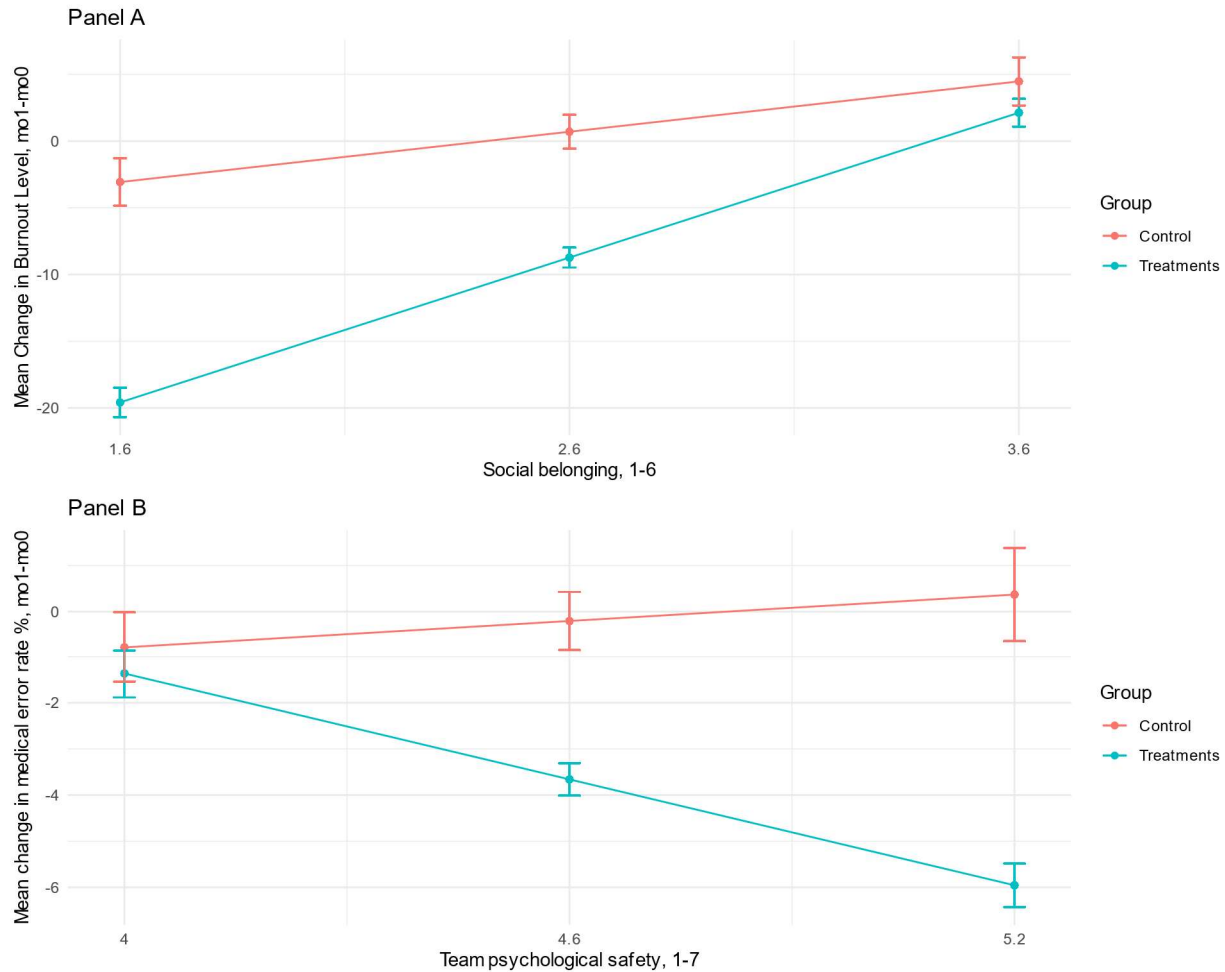
To further explore why the combined intervention had larger and longer effects, we analyzed some instant measures right before and during patient rounds. Panels A and B of Figure 6 below show that nurses were more anxious (MDR vs. Control, $B=1.93$, $SE=0.52$, $t=3.72$, $P<0.001$) and less looking forward to rounds (MDR vs. Control, $B=-0.44$, $SE=0.17$, $t=-2.62$, $P=0.009$) when they had to round with doctors compared to rounding as usual; However, after they received affirmation, the effects were reversed: nurses were less anxious (Affirm + MDR vs. Control, $B=-1.55$, $SE=0.52$, $t=-2.95$, $P=0.003$) and more looking forward to rounds (Affirm + MDR vs. Control, $B=0.32$, $SE=0.17$, $t=1.87$, $P=0.06$) when they had to round with doctors compared to rounding alone. Panels C and D of Figure 6 show that after receiving affirmation, nurses reported both a greater number of communications with doctors during MDR (Affirm + MDR vs. MDR, $B=0.42$, $SE=0.21$, $t=1.97$, $P=0.05$) and higher quality of these communications (Affirm + MDR vs. MDR, $B=5.30$, $SE=1.90$, $t=2.79$, $P=0.005$). These measures suggest that when affirmation and MDR are combined back-to-back, nurses appraised MDR as an opportunity rather than a threat and were more likely to share critical patient information during MDR.

Figure 6. Attitudes Towards and Communications During Rounds.



Moderators. We explored heterogeneity in intervention effects. As shown in Panel A of Figure 7, teams with higher psychological safety saw greater reductions in medical errors, which were consistent with the information sharing mechanism. Panel B of Figure 7 shows that nurses with lower sense of social belonging saw larger reductions in burnout, which were consistent with the emotional support mechanism. Overall, these moderators further evidence the crucial roles of team dynamics in medical error and burnout reduction.

Figure 7. Moderation by Teamwork-Related Variables



Robustness Analyses. The results were robust to adding a host of covariates, including team-average age, gender, ethnicity, weekly work hours, annual personal income, educational level, professional grade, political ideology, marital status, and number of children as well as team size, team composition, and hospital fixed effects. The results were robust to using difference in outcomes or controlling for baseline in regression analyses. The burnout results were robust to fitting hierarchical linear models in Table B1 in Appendix B. The heterogeneity analysis was robust to fitting Bayesian causal forest models in Figure B1 in Appendix B.

5. Discussion

A key challenge of modern society is to enable people from different backgrounds to work together, sharing constructive information to solve difficult problems and offering emotional support to face challenges collectively (Mousa, 2020). In both society and the workplace, barriers to effective teamwork exist. A key debate in sociology and psychology is whether psychological or structural change is more effective in improving intergroup relations.

We conducted a field experiment to test the relative efficacy of social-psychological and network interventions, and our findings partly resolved the debate. We demonstrated that both self-affirmation and network interventions are effective, but they work best when combined. We also show that for social-psychological interventions to be effective, relational context matters: self-affirmation is most effective when the infrastructure of team psychological safety already exists, and it benefits those who are in greatest need of social belonging. Taken together, we argue that behavioral and structural changes are like seed and soil, triggering a positive feedback loop when pursued simultaneously.

We tested this hypothesis in the important context of interprofessional teamwork in healthcare and examined the critical outcomes of medical errors and clinician burnout. While scholars agree that “to err is human” and acknowledge the multilevel causes of burnout, less is known about whether it is preferable to target individual psychology or the organizational system (West et al., 2016). We show that either social-psychological or network interventions can prevent medical errors and burnout, but they work best when integrated. Both interventions are much more cost-effective than the existing solution of TeamSTEPPS training (King et al., 2008), which requires several days and a few hundred dollars per participant.

In conclusion, to improve intergroup relations, more social-psychological interventions could be integrated with network interventions (Valente, 2012), as behavioral change and social change seem complementary.

ONLINE APPENDIX

Appendix A: Experimental Materials

Appendix A1: Values-Affirmation Intervention Materials

Intervention Condition:

We hope to gain a deeper understanding of people's values, and we will be asking you a series of related questions. Please rest assured that your responses will not be disclosed to any third parties, including the hospital management. All answers will be analyzed in an anonymous and aggregated form. We greatly appreciate your support for this survey.

Please carefully read this list of values. Then circle the TWO or THREE values that are MOST important to you. There are no right or wrong answers. Even if you feel that many of the values are important to you, please just pick two or three.

Sports or Athletic Ability

Creativity

Music and Art

Relationships with Friends or Family

Independence

Belonging to a Social Group

(such as your community, your religion, or a club)

Spiritual Values

Sense of Humor

Kindness

Appearance and fitness

Live at present

Joy of learning

Romance

Directions:

1. Look at the values you picked as most important to you.
2. Think about times when these values were or would be very important to you.
3. Describe why these values are important to you. Focus on your thoughts and feelings, and don't worry about spelling, grammar, or how well written it is.

Control condition:

We hope to gain a deeper understanding of people's values, and we will be asking you a series of related questions. Please rest assured that your responses will not be disclosed to any third parties, including the hospital management. All answers will be analyzed in an anonymous and aggregated form. We greatly appreciate your support for this survey.

Please carefully read this list of values. Then circle TWO or THREE values that are NOT important to you. There are no right or wrong answers. Even if you feel that several of the values are not important to you, please just pick two or three.

Sports or Athletic Ability

Creativity

Music and Art

Relationships with Friends or Family

Independence

Belonging to a Social Group

(such as your community, your religion, or a club)

Spiritual Values

Sense of Humor

Kindness

Appearance and fitness

Live at present

Joy of learning

Romance

Directions:

1. Look at the values you picked as NOT important to you.
2. Think about times when these values would be important to someone else (like another person you've heard about).
3. Describe why these values would be important to someone else. Focus on your thoughts and feelings, and don't worry about spelling, grammar, or how well written it is.

Appendix A2: Sample Responses from Values-Affirmation

Intervention Condition:

Kindness: “A kind person, her words and behaviors are full of love and compassion. This will bring her unlimited blessing. In our life journeys, we will face a lot of hardships and challenges, but as long as we keep a thought of kindness in our heart, we will find power to move forward, finding a direction for our puzzled lives.” – an obstetrics and gynecology nurse

Sense of Humor: “Humor is an indispensable part of human lives. It not only can bring happiness and laugh, but also have many positive benefits on mental and physical health. In modern society, lives are full of pressure and quick rhythms, which make sense of humor particularly important. Humors can reduce stress, can help us relieve anxiety and panic, can change our perspectives of viewing problems, making it more relaxed and manageable. In addition, humor can increase positive emotions. Laughter will release endorphins, which is a natural “happiness hormone.” It can enhance our mood and improve our emotional well-being. Humor can also build and strengthen social relationships. People with sense of humor are more attractive, being able to build good communication and interactions with other people.” – a surgical nurse supervisor

Appearance and fitness: “Appearance and fitness are equally valuable to me because they not only influence my self-confidence, but also reflect my priorities for health and self-care. Whenever I keep a good figure through exercises, I feel full of energy and renewed spirit. These values are especially salient when I face challenges or need to make a key decision, because they keep me balanced, with a positive attitude, and promote me to always move forward.” – an ICU nurse

Control Condition:

Sense of belonging: “Belonging comes from the emotional needs of hoping to be accepted and acknowledged. Belonging is not from being part of a collective group, but from having the same experiences, similar feelings, and similar interests and hobbies, whereby we get happiness and condolence. I find it hard for everyone to feel this way in a social group. Of course, it is great to integrate into the joy of a group of people, but it is normal to enjoy the loneliness of your own.” – a surgical nurse

Romance: “Pursuit of romance is not important, but life is not a poem but daily necessities [firework, rice, oil, and salt]. However, this can be very important to other people. It is their important way of feeling love and being loved. It is their means to improve intimate interpersonal relationship. These values will give them condolence when they face emotional distress. They will provide strength when they need support. They will give them direction and motivation when they are looking for meaning of life.” – an internal medicine head nurse

Appearance and fitness: “For many people, appearance and fitness are important components of self-evaluation. Societal culture usually places emphasis on appearance. Media and social media are full of these evaluations, which make more people value these external traits. For people who pay attention to these appearance and fitness, they usually care about health and life, which reflect their self-discipline and self-management.” – an emergency room nurse

Appendix A3: Notification Procedures and Scripts

Notification by 10 RAs for Round Intervention:

Dear Department Chair, hello! I am an assistant for the healthcare management research project. This week, you need to notify all attending and resident doctors of the following medical teams that starting from next week, there will be joint rounds by doctors and nurses every Monday morning. The medical teams that need to be informed of the joint rounds by doctors and nurses are: XXX, while other doctors will continue their normal rounds as usual. When do you think you can finish notifying them? Once you have completed the notifications, please inform me of the doctors who have been notified, as this will help us keep track.

Additionally, a brief questionnaire needs to be filled out immediately before and after the rounds. Please ensure all doctors participating in the rounds with nurses complete it.

Dear Nurse Manager, hello! I am an assistant for the healthcare management research project. This week, you need to notify all nurses and head nurses of the following medical teams that starting from next week, there will be joint rounds by nurses and doctors every Monday morning. The medical teams that need to be informed of the joint rounds by nurses and doctors are: XXX, while other nurses will continue their normal rounds as usual. When do you think you can finish notifying them? Once you have completed the notifications, please inform me of the nurses who have been notified, as this will help us keep track.

Additionally, a brief questionnaire needs to be filled out immediately before and after the rounds. Please ensure all nurses participating in the rounds with doctors complete it.

Notification by 20 RAs for Affirmation Intervention:

Dear Nurse Manager, hello! Next Monday from 7 AM to 9 AM, all nurses and head nurses need to complete a questionnaire. There are two meeting rooms available, with nurses from these medical teams going to Room A: XXX, and nurses from these medical teams going to Room B: XXX. Please check in at the door, and after completing the questionnaire, we will provide complimentary breakfast. Please urge all head nurses to ensure that all nurses complete the questionnaire.

Notification by 5 RAs for Surveys:

Dear Department Chairs, hello! Tomorrow, all attending and resident doctors need to complete a questionnaire. Please inform the doctors that their responses are confidential and visible only to researchers outside the hospital. Please urge all attendings to ensure that all doctors complete the questionnaire.

Dear Nurse Managers, hello! Tomorrow, all nurses and head nurses need to complete a questionnaire. Please inform the nurses that their responses are confidential and visible only to researchers outside the hospital. Please urge all head nurses to ensure that all nurses complete the questionnaire.

Appendix A4: Sample Survey Items

Manipulation Checks

[**State Anxiety**] (STAIAD Short Form Y-1) A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel **right now**, that is, **at this moment**. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

1. I feel calm
2. I am tense
3. I feel at ease
4. I am presently worrying over possible misfortunes
5. I feel frightened
6. I feel nervous
7. I am jittery
8. I am relaxed
9. I am worried
10. I feel steady

Not at all, somewhat, moderately so, very much so

[**Expectation of Round**] (Duck et al., 1991) How much are you looking forward to the round?

1 2 3 4 5 6 7 8 9

Looking Forward to Round; Dreading Round

[**Communication quantity**] (Emmers-Sommer, 2004) How many times did you communicate with a doctor/resident during the round today?

_____ (enter a whole number, 0-8)

[**Communication quality**] (Iowa Communication Record, Duck et al., 1991)

Describe the quality of communication between nurses and doctors/residents during the round today:

1. Relaxed; Strained

1 2 3 4 5 6 7 8 9

2. Impersonal; Personal

1 2 3 4 5 6 7 8 9

3. Attentive; Poor Listening

1 2 3 4 5 6 7 8 9

4. Formal; Informal

1 2 3 4 5 6 7 8 9

5. In-depth; Superficial

1 2 3 4 5 6 7 8 9

6. Smooth; Difficult

1 2 3 4 5 6 7 8 9

7. Guarded; Open

1 2 3 4 5 6 7 8 9

8. Great Deal of Understanding; Great Deal of Misunderstanding

1 2 3 4 5 6 7 8 9

9. Free of Communication Breakdowns; Laden with Breakdowns

1 2 3 4 5 6 7 8 9

10. Free of Conflict; Laden with Conflict

1 2 3 4 5 6 7 8 9

Mediators

Instructions:

We would like to learn more about how you communicated with your team members.

We understand that circumstances may change daily, so we will ask these questions multiple times. Please answer the questions based on what you did **today**.

There is no correct or wrong answer, and your response will **not** be shared to any third party, including the hospital management.

[Information Sharing to Doctors] How many times did you reach out to **doctors/residents** in your team to discuss your patients **today**?

_____ (enter a whole number, 0-6)

[Emotional Support from Doctors] How many times did you receive emotional support from **doctors/residents** in your team **today**?

_____ (enter a whole number, 0-6)

Moderators

Instructions:

We would like to learn more about your medical team.

We understand that circumstances may change monthly, so we will ask these questions multiple times. Please answer the questions based on what you did **in the last month** and **in your medical team**.

There is no correct or wrong answer, and your response will **not** be shared to any third party, including the hospital management or any team members.

[**Psychological Safety**] (Edmondson, 1999)

In the last month and **in your medical team**, how much do you agree with the following statements:

1. People here are able to bring up problems and tough issues.
2. It is safe to take a risk around here.
3. No one around here would deliberately act in a way that undermines my efforts.
4. Working with people here, my unique skills and talents are valued and utilized.
5. If you make a mistake around here, it is often held against you.*
6. People around here sometimes reject others for being different.*
7. It is difficult to ask other people around here for help.*

Strongly agree, agree, somewhat agree, neither agree nor disagree, somewhat disagree, disagree, strongly disagree

[**Social Belonging**] (Walton and Cohen, 2007; 2011)

Answer the following questions about what **your medical team** is like for you **in the last month**.

1. I feel like I belong in my medical team.
2. People in my medical team accept me.
3. I feel like an outsider in my medical team.
4. I feel comfortable at work in my medical team.
5. I know what I need to do to succeed in my medical team.
6. People in my medical team are a lot like me.
7. I am the kind of person that does well in my medical team.
8. There is someone in my medical team who I can count on.
9. I feel very different from other people in my medical team.

Strongly disagree, disagree, slightly disagree, slightly agree, agree, strongly agree

Appendix B: Robustness Checks

Table B1. Robustness Check for Burnout Level Analysis Using HLMs

Group	Period	Estimate	Standard Error	t-value
Affirmation vs. Control	1	-4.43	1.09	-4.06
	2	-2.1	1.4	-1.5
	3	-1.71	1.65	-1.04
	4	0.38	1.85	0.21
MDR vs. Control	1	-7.61	1.14	-6.7
	2	-5.96	1.48	-4.02
	3	-4.76	1.59	-3
	4	-1.84	1.81	-1.02
Affirmation+ MDR vs. Control	1	-12.68	1.21	-10.46
	2	-11.77	1.47	-8
	3	-9.56	1.52	-6.31
	4	-7.3	1.7	-4.29

Figure B1. Bayesian Causal Forest Models for Heterogeneous Treatment Effect

