Original Publication

Dyspnea in a Hospitalized Patient: Using Simulation to Introduce Interprofessional Collaborative Practice Concepts

Sharon Wilson, RN, MSN*, Linda Vorvick, MD

*Corresponding author: wilsonsj@uw.edu

Abstract

Introduction: Improved team communication is essential in preventing errors in patient care. Based on TeamSTEPPS concepts, we developed this simulation case scenario to engage learners from various health care professions in interprofessional teamwork. The case was developed for graduating medical, physician assistant, and nursing students with clinical experience, as well as pharmacy students just beginning clinical rotations. **Methods:** Learners are evenly distributed into groups based on their professional training to provide an opportunity to function as a team. Faculty receive case materials prior to the day they will be volunteering and receive just-in-time training to refresh medical management knowledge and to prepare them for interprofessional facilitation, debriefing, and team skills. Faculty start by introducing interprofessional teamwork skills based on TeamSTEPPS concepts and providing an activity in which teams compete to create the longest paper chain. Next, faculty run a scenario featuring a standardized patient or high-fidelity manikin developing dyspnea in a simulated hospital setting. Learners can use skills from their profession-specific education as well as theoretical knowledge while demonstrating interprofessional communication skills during the simulation. **Results:** Overall, 1,475 students have been trained with this resource over the last 5 years. Evaluations completed by learners postsimulation have rated this resource favorably. This resource has equivalent outcomes to two other scenarios also in the workshop series, indicating that using this resource alone will meet the workshop objectives. **Discussion:** This simulation experience advances the work of interprofessional education in developing increased self-efficacy in learners to be able to implement team skills and work in an interprofessional team.

Appendices

A. Dyspnea Case Simulation Template.docx
B. Dyspnea Case Diagnostic Test Results.docx
C. Learner and Faculty Materials.docx
D. Dyspnea Case Debrief Materials.docx
E. TeamSTEPPS Introduction .docx
F. Dyspnea Case Storyboard .docx
G. Dyspnea Case Standardized Patient.docx
H. Evaluation.docx
I. Dyspnea Medical Management Overview .docx
J. Dyspnea Scenario Orientation.docx

All appendices are peer reviewed as integral parts of the Original Publication.

Keywords

Interprofessional Education, Simulation, Heart Failure, Dyspnea, TeamSTEPPS, Interprofessional Teams, Interprofessional Collaborative Practice

Educational Objectives

After completing the simulation training session, learners will be able to:

1. Apply values and ethics for interprofessional practice in collaboration with individuals of other professions to maintain a climate of mutual respect.

2. Use the knowledge of their own role and that of other professions to appropriately assess and address the health care needs of the patient.

3. Demonstrate communication skills with patients, families, and other health professionals in a responsive and responsible manner that supports a team approach to the maintenance of health and the treatment of disease.

4. Apply relationship-building values and principles of team dynamics to perform effectively in different team roles to plan and deliver patient-centered care that is safe, timely, efficient, effective, and equitable.

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Introduction

Research has shown that 80% of errors initiating a chain of events involve communication.[1] This resource is designed to provide a systematic and pedagogical framework for students to learn interprofessional team skills and apply newly learned skills in their practice. It was born out of the Capstone Interprofessional Acute Care Scenarios, a curriculum developed and tested at the University of Washington in 2011 as part of an interprofessional team training grant supported by the Josiah Macy Jr. Foundation. Following the success of the 2011 pilot program, the schools of nursing, pharmacy, and medicine and the MEDEX physician assistant programs joined together to provide an interprofessional student-training experience for over 400 students during 1 week each year. Overall, 1,475 students have been trained in the last 5 years, from 2011 to 2015. Students in medicine (fourth-year graduating medical students or second-year clinical physician assistant students), nursing (fourth-year graduating bachelor of science in nursing students), and pharmacy (third-year pharmacy students) learn skills based on interprofessional competency domains that include values and ethics, roles and responsibilities, communication, and teams and teamwork.

The overall goal of this resource is to apply interprofessional team skills in the care of hospitalized patients. The Educational Objectives are based on the Core Competencies for Interprofessional Collaborative Practice developed by the Interprofessional Education Collaborative Expert Panel.[1] This resource advances interprofessional education skills development by providing a curriculum that is mapped to interprofessional competencies. Additionally, it has proven its value during 5 years of implementation across multiple health professional schools. This resource has been tested for authenticity of roles and communication skills in a realistic teamwork setting. Outcomes of this work have been published, and this guide makes the curriculum available for others to replicate. The scenario is updated yearly based on a review of relevant resources.[2-5]

A team-based approach to medical care is critical to improving patient outcomes in practice. Medicine, physician assistant, pharmacy, and nursing students who are about to enter residency or clinical practice require the skills of team-based care in the hospital setting. Many hospitals have invested in team communication skills training to improve patient care, and they expect residents and recent graduates to have basic knowledge and experience of teamwork and team communication skills. This interprofessional simulation is designed to translate clinically relevant communication skills used in health care teams into future health care settings. Using Kirkpatrick's model modified for interprofessional education, the level of learning integrated into the simulation supports acquisition of skills and knowledge necessary for transforming practice.[6] The intentional emphasis on communication skills between professions during the simulation, rather than clinical management in caring for the patient, creates a robust interprofessional learning environment.

Simulation and interprofessional educational objectives historically include parallel objectives for skill training or patient management and infrequently have a curriculum directed specifically to improving collaboration between two or more health care disciplines.[7-12] Our conceptual framework is designed to emphasize collaboration skills and attitudes through a unique combination of simulation, instruction in TeamSTEPPS concepts, and team-building activities to enhance team learning.[7,10] The inpatient dyspnea case functions as an educational tool to provide the opportunity for medical, nursing, and pharmacy students to interact based on their professional strengths and knowledge.[11] The detailed guide and complete appendices enable replication of a scenario that has over the past 5 years evolved to reduce variables that distract from our interprofessional education objectives.

Methods

The ideal learners for this resource are those who are either close to graduation or entering their clinical experiences in their respective courses of study and anticipate placement in a hospital setting. However, the application of these team communication skills for learners in other health care settings is valuable.

Any profession such as nurse practitioners or lab technicians that cares for hospitalized patients could potentially have a role written into this case, in addition to the roles already developed for it.

To start, all participants divide into small groups and function as a team for the remainder of the session. They are then given an overview of TeamSTEPPS concepts[13] in a 50-minute segment at the beginning of the session (Appendix E). An activity in which teams compete to create the longest paper chain is included to demonstrate team concepts, with a debriefing to focus on how a team might work to accomplish a goal.[14] A variation on this team-building exercise is repeated during the final large-group debriefing. Each learner receives an index card with TeamSTEPPS skills that will be emphasized during the simulations that follow the introduction.

In the smaller groups, a refresher of the medical management for dyspnea may be conducted informally by a review of selected journal articles or more formally within a program's seminar class. In this scenario, dyspnea is used to describe a patient with disordered or inadequate breathing.[15] A team brief of medical management is held prior to beginning the scenario, or a debriefing of medical management can be done after the scenario. Appendix I provides an outline of possible diagnoses and treatments to review with learners. Debriefing time is allotted for each scenario and also during the combined small-group debrief at the end of the session to reinforce the TeamSTEPPS terminology, what has been learned, and what participants would do differently.

Equipment and Scenario Environment
Before the scenario begins, learners are oriented to the scenario environment and equipment to increase their comfort with what is available to them during the scenario. Appendix J provides an overview of the orientation content to be presented by faculty to set the stage for the scenario and provide an opportunity to answer questions. Additional information and details are included in the Dyspnea Case Simulation Template (Appendix A), the Dyspnea Case Diagnostic Test Results (Appendix B), the Dyspnea Case Storyboard (Appendix F), and the Dyspnea Case Standardized Patient (Appendix G).

Simulator: A patient-actor (standardized patient) with Ventriloscope or a high-fidelity manikin with lung and heart sound technology, dressed in a hospital gown and pajama bottoms or scrub pants, with a simulated urinary catheter and peripheral IV, as well as a pulse oximeter on a finger, sits on the edge of a bed, struggling to breathe. Sounds of the simulation include lower lobe crackles and murmur of aortic stenosis.

Hospital equipment:

- Hospital bed with pillow, sheets, and blanket.
- Bedside table.
- Telemetry monitor available to continuously display team-requested blood pressure, temperature, respiratory rate, heart rate and rhythm strip, and oxygen saturation.
- Blood pressure cuff (not connected).
- Exam gloves.
- Ventriloscope stethoscope or regular stethoscope if using a manikin.
- Patient identification band with name, age, and known drug allergies.
- ECG electrodes (optional).
- Pulse oximeter (not connected).
- Hand gel.
- Exam gloves.

Electronic equipment:

- Desktop computer with monitor and on-screen icons or printed copies of diagnostic testing.
- History and physical from Emergency Department (ED).
- ED lab results.
- ED chest X-ray graphic and report.

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- Monitor to display results or paper copies of results for ordered diagnostic testing. See Appendix B for individual realistic lab and chest X-ray results that might be ordered during the scenario.

Respiratory equipment:

- Nasal cannula.
- Nonrebreather mask.
- Oxygen flow meter.
- Pulse oximeter finger probe.

Urinary catheter equipment:

- Foley catheter.
- Collection tubing and collection bag containing 50 cc to start.
- IV bag 1000 mL filled with simulated urine (yellow water), connected to collection tubing for release of urine into urine bag if given furosemide to simulate diuresis.

IV equipment:

- IV pole.
- IV infusion line (Y-administration set for blood infusion) with drainage for IV push meds.
- Two IV bags lactated Ringer's solution with label.
- Infused blood bag with label.

Medications and equipment:

- Furosemide 20 mg/mL (one vial labeled *20 mg/mL*).
- Morphine 1 mg/mL (one vial labeled *1 mg/mL*).
- Nitroglycerin 0.6-mg sublingual tablets (Tic Tacs).
- Aspirin 325 mg (Tic Tacs).
- Five paper cups for giving oral meds prn.
- Syringes without needles, three 3-mL and three 5-mL. Label 5-mL syringe *Lasix 20 mg/mL.* Label 3-mL syringe *Morphine 1 mg/mL.*
- Alcohol wipes for cleaning stethoscope earpieces and vials.

Lab draw equipment:

- Blood tubes (purple top and red top without needles).

A Ventriloscope should be set to initially feature abnormal breath sounds when the posterior chest is auscultated. The standardized patient uses a remote to switch to abnormal heart sounds if someone listens to his or her anterior chest towards the end of the scenario, after furosemide or other medication is given. As a tip, turn off the Ventriloscope and remote between scenarios to reboot. Connecting the Ventriloscope to a loudspeaker so everyone can hear the sounds is a plus.

For the intravenous fluids, gauze should be wrapped around the right or left arm, with tubing taped in place. The urine bag and tubing system should be concealed under bedcovers to simulate diuresis. The standardized patient can open the valve when furosemide is given intravenously. Check before each scenario that the tubing is not kinked.

An oxygen saturation probe should preferably be placed on the index finger, opposite the hand needed to turn on the urine-delivery apparatus or to use the Ventriloscope remote control. The electrocardiography electrodes and oxygen saturation probe may need to be replaced in order to get a readout on the monitor.

Personnel
Faculty volunteers are recruited by the deans of the professions taking part in the simulation. Faculty volunteers sign up for specific days and whether they will be a part of the morning and/or afternoon

sessions. The Figure provides an example of the faculty assignment grid. The team lead provides training as needed in the dyspnea case scenario and in simulation. The team lead is generally someone with expertise in simulation. Having a colead helps distribute the work of preparation and provides a backup for unforeseen problems. The Learner and Faculty Materials file (Appendix C) provides more information. Detailed responsibilities are delineated below.

Tuesday AM at HMC	HMC	Faculty
Dyspnea	Sharon W.	Lead
	Alan C.	Nursing
	Linda V.	Medicine
	Chris C.	Pharmacy
	John Q.	SP
	Tony	Tech

Figure. An example of a faculty assignment grid. HMC, Harborview Medical Center; SP, standardized patient.

Faculty Roles

The dyspnea case lead faculty oversees general running of the scenario, standardized patient supervision, orientation of students and faculty to the scenario, and troubleshooting of problems. The lead faculty is responsible for all preparations for the dyspnea scenario, including updating content and diagnostic testing, meeting with the simulation lab tech to review supplies and equipment, reviewing the script with the standardized patient, faculty training, and conducting a dry run of the scenario to troubleshoot problems. During the session, the lead faculty should coordinate faculty volunteers and provide just-in-time training as needed, oversee the scenario, consult with other faculty to solve problems, and be available each day to meet with larger groups to debrief. The lead faculty also must participate as a coach for any learner as needed.

The lead faculty may delegate any tasks, such as debriefing, timekeeping, review of medical management, orientation of participants to the simulation environment, orientation of observers to their role during the scenario, or distribution of diagnostic testing results either in paper form or on a computer monitor, to other faculty members based on their experience. In an ideal world, a colead is an asset in managing all the complexities of the preparation and running of the simulation.

The nurse faculty plays the role of the evening charge nurse giving a report to the primary and second nurses at shift change. Once the scenario has started, the nurse faculty listens for the nurses to express the need for a medical team and then tells them, "I saw the medical team in the hall. I will let them know you need them." During the scenario, the nurse faculty should provide medical management coaching as needed.

The medicine faculty plays the role of the primary intern providing the handoff to the cross-cover medical and pharmacy teams with a brief discussion of patient status. The medicine faculty assists in the selection of a medical team leader and emphasizes that the leader is not a doer. During the scenario, the medicine faculty provides medical management coaching as needed. Just before the 15-minute scenario time limit is reached, the medicine faculty steps in as the primary intern receiving the handoff report for the patient in the morning to end the scenario. Any other faculty may take on this role if the medicine faculty is not available.

The pharmacy faculty joins the medicine group at the beginning of scenario to receive the handoff information being provided by the primary intern. The pharmacy faculty then reviews with students what their roles might be as part of the team taking care of the patient with dyspnea. During the scenario, the pharmacy faculty provides coaching, especially if pharmacy students are not yet in clinical rotations and require additional support in speaking up concerning medications and dosing.

All faculty should be available to step into the scenario to assist with medical management content either by learner request or if needed to guide the scenario to completion. Faculty may also call a huddle at any time. If there is no faculty representative for a specific profession, another faculty may step in.

Volunteer faculty are recruited by school deans, previous faculty participants, and recruitment emails sent to faculty of medicine, nursing, pharmacy, and physician assistant departments. Faculty may volunteer for multiple sessions or only one. Faculty within the various professional training programs assist in preparing students for the simulation by incorporating the medical management of a patient with dyspnea into their seminars or lectures. Journal articles may also be suggested so learners have a knowledge base in treating dyspnea before the simulation, as this will not be the focus of the simulation.

Faculty are then assigned to a scenario for the days they have indicated availability. Approximately 1 week prior to the first day, an email with case materials and online resources is sent. Learners are sent a similar email with information pertinent to their needs for the day, such as when to arrive, what to wear, and directions to the venue.

In addition to faculty needs, the resource requires an experienced lab technician. The lab technician is responsible for the behind-the-scenes running of the scenario equipment, including securing supplies and equipment and replenishing supplies as needed. Tasks include mixing the urine in the bag, rigging the urine system, hooking up the speaker to the Ventriloscope, charging the Ventriloscope between groups, emptying the urine collection bag at end of each scenario, helping standardized patients with props (such as the hidden catheter, blood pressure cuff, and remote control device for the Ventriloscope), and placement of the pulse oximeter. Additionally, the technician must ensure correct operation of the telemetry monitor, connection of the oxygen flow meter, and functioning of the vital signs monitor.

The technician also is needed to upload normal and crackling breath sounds and/or normal and aortic stenosis heart sounds. In this scenario, vital signs change based on learner interventions, such as increasing heart and respiratory rates during the shortness of breath sequence. Then, if appropriate interventions are made, these vital signs improve.

The technician also needs to collaborate with the lead faculty as to how the patient chart and diagnostic testing results are displayed for learners during the scenario. Together, they can review supplies and equipment needed and can schedule a dry run of the scenario, including reviewing and updating the storyboard. During the dry run, problems can be solved and improvements made as needed.

Assessment

Summative evaluation tools are used to evaluate the learners' satisfaction with the simulation, their application of team communication skills during the simulation, and overall peer performance. Additionally, summative evaluation tools can provide them with an opportunity for self-reflection. During the scenario, a peer evaluation is completed by learners who are not directly participating in the scenario. After the scenario, a team debriefing is presented by a faculty facilitator. Finally, at the end of the simulation experience, there is a large-group debrief and individual learner evaluation.[13]

Peer Evaluation

A student observer form (Appendix H) is completed by learners who are not directly participating in a scenario. This tool was developed as part of a PhD dissertation to engage nonparticipating learners in identifying team skills during an interprofessional team scenario.[14] The observers are provided with a form to rate team structure, leadership, situation monitoring, mutual support, and communication as either poor, average, or excellent.

The observers are provided with the form, a clipboard, and a pen and encouraged to sit where they can observe and hear the scenario. The observers may be directed to evaluate a simulation participant who is from the same professional school as theirs, a simulation participant who is from a professional school different from theirs, or any simulation participant.

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They may make notes or comments and are encouraged to participate in the debriefing. Their forms are collected at the end of the debriefing. The responses can be collated to compare the progress the groups have made in their team communication skills from their first scenario experience to their last.

Individual Evaluation Form

Each individual is offered the opportunity to complete an optional, anonymous evaluation form (Appendix H) at the end of the session. The form is given to learners at the end of the combined group debriefing to be completed before leaving and receiving their certificates of completion. Ratings range from *strongly agree* to *strongly disagree* on questions related to learners' personal experience, specific scenario appropriateness, and faculty strength. As the responses may provide insight into learners' integration of teamwork skills and concepts, the most revealing section is a general question: "What will you take away from today's session that will apply to your future practice?"

Results and comments are compiled and used to evaluate acceptance of content presented and to modify future simulations.

Debriefing

In teams at the end of the scenario, a brief discussion of the clinical management of the dyspneic patient is followed by open-ended questions presented by a faculty facilitator to stimulate discussion related to team communication and the team's performance during the scenario. Similar open-ended questions are asked during the combined group at the closing of the session. Responses may be documented on a flip chart or wipe board. Debriefing is where the learning takes place, as participants start to reflect on their own learning. See the debrief materials scenario and session debriefing (Appendix D) for more information.

Through the implementation of these resources, we have accrued some general debriefing tips for the facilitators. First, let the learners do most of the talking. The facilitator's role is to stimulate learner discussion, allowing for moments of silence and prompting discussion with open-ended questions during the debriefing. Allow the learners the opportunity to bring up issues they feel need to be discussed and finish by addressing them.

Also, start by addressing clinical omissions, successes, or other clinical issues the team brings up. Learners will not be able to focus on communication skills if major clinical questions or concerns are not addressed. However, do not spend more than 5 minutes on the patient's clinical management. A review of the medical management of the hospitalized patient with dyspnea is often done before the scenario, with notes made on a wipe board for reference during the scenario events. As an option, reviewing clinical management after the scenario has been successful as it connects the team's patient care during the scenario to the theoretical model learned as part of the team members' academic classwork. The facilitator can encourage a discussion of the team's care and how the differential diagnoses were supported or eliminated based on the team's actions. The facilitator focuses on what the team did correctly, who contributed to the team, and what participants would do differently next time.

Spend the majority of the debrief time on TeamSTEPPS concepts. Start by asking open-ended questions, beginning with "What went well?" Then ask, "What could you have done better?" Transition to "What will you do differently next time?" Because the learners are self-reflecting, the responses are not viewed as criticism. As learners respond, rephrase their responses back to them as TeamSTEPPS skills that are to be emphasized in the module for this scenario rotation. In the first scenario rotation in which learners participate, use the 100-level communication skills to guide the debriefing. This process is repeated in the second and third scenario rotations, using the 200-level and 300-level communication skills, respectively, to guide the debriefing. If a skill was not demonstrated during that particular scenario rotation, then discuss ones that were, using TeamSTEPPS terminology such as *cross-check, SBAR* (situation, background, assessment, recommendation and request), *huddle,* and *shared mental model.*

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The facilitator should encourage the observers to contribute to the debriefing. Faculty may also contribute if a salient point has not been identified by the learners but should avoid lecturing or focusing on the medical management. The standardized patient is allowed a few moments to provide the patient perspective as a team member and what it was like to be the students' patient. The standardized patient may also provide examples of team behaviors with an emphasis on the positive.

The three levels of debriefing correspond to a progression in the learning experience with team communication concepts as learners move through three consecutive scenarios. The suggested outline is for faculty to reinforce a variety of TeamSTEPPS concepts.

Each level of debriefing begins with time for students to decompress following the stress of the scenario. This is achieved by having a quick discussion of the medical management of the patient and then redirecting students to team communication skills.

Next, ask the following questions with a focus on team communication during the scenario: What went well? What could you have done better? What will you do differently next time? Remember to allow time for the standardized patient to give feedback about what it was like to be the students' patient. Encourage observers to participate also. Faculty may participate once the learners seem to have no further comments or in order to reinforce a student comment.

Finally, wrap up with a combined, large-group debrief at end of the session focusing on team communication skills and following a similar process to that outlined above. A variation of the paper chain exercise can be used to reinforce team concepts and encourage teams to work together. During the large-group debrief, learners often express a new understanding of other professional scopes of practice. This is an opportunity to dispel myths and stereotypes through open and honest discussion.

Results

Overall, 1,475 students have been trained with this scenario over the last 5 years, with comparable data available from 2013 to 2015. Evaluations completed by learners postsimulation support the intended outcomes targeted in the Educational Objectives (see the Table). Scores by learners over the last 3 years have been on the high end of a 5-point Likert scale, with a rating of 5 being the best. "The workshop was useful and practical" was given a rating by learners of 4.73 out of 5. "I learned new skills" was given a 4.63. The dyspnea in a hospitalized patient scenario has equivalent outcomes to two other scenarios used in our workshop series, indicating that using this scenario alone will meet the workshop objectives.

Table. Outcomes of Postsimulation Evaluation 2013-2015[a]

Question	2013	2014	2015	Average
The workshop was useful and practical.	4.66	4.72	4.82	4.73
I learned new skills.	4.58	4.61	4.69	4.63
I was sufficiently oriented to the manikins and equipment.	4.57	4.41	4.44	4.47
The workshop enhanced my understanding of other professions' roles and responsibilities.	4.57	4.47	4.76	4.6
The scenario was appropriate to my level of training.	4.69	4.65	4.6	4.64
The faculty were excellent.	4.78	4.75	4.69	4.74

[a]Scale: 1 = *Strongly Disagree,* 5 = *Strongly Agree.*

Qualitative comments by learners answering the question "What will you take away from today's training?" almost exclusively focused on the importance of TeamSTEPPS skills and communication between professions. In 3 years of learner comments, there have been fewer than five comments focusing on the clinical care provided in the scenarios. Qualitative comments to an open-ended prompt have been more varied, with themes emerging around the value of the experience, the wish that there were more opportunities like these simulations during the students' professional training, and the importance of teamwork and communication skills.

Discussion

A limitation of the scenario is revealed in learner comments, with the quantitative scores for "I was sufficiently oriented to the manikins and equipment" being the lowest overall (4.47 out of 5). A lack of

experience with simulation, the time needed to effectively orient learners to the simulation equipment and the manikin, and a feeling of being overwhelmed by the equipment or the medical content probably account for these scores. Not all professional educational programs use simulation during their training of learners, with some schools using it frequently and others rarely. There also can be a large variation in the equipment and manikins used. Future workshops with this simulation would benefit from more orientation to simulation and an opportunity for simulation practice.

The dyspnea scenario is clinically accurate, easy to run, and focuses on team skills over clinical management. It has been modified over the course of implementation so that it is optimized for flexibility and maintaining a team-skills focus while deemphasizing the patient clinical management. The workshop is dynamic, with two additional scenarios featuring equivalent opportunities to practice interprofessional teamwork. The session can also be run with this one scenario repeated to allow the observing students the opportunity to participate in the scenario.

The effectiveness of using simulation to teach interprofessional team skills has been described by Brock et al.[16] The outcome was a change in learner knowledge and increased self-efficacy in being able to implement team skills after practicing them within the safe environment of simulation. Pre- and postassessment tools were used to measure the change.[16]

Sharon Wilson, RN, MSN: Clinical Faculty Member, University of Washington School of Nursing

Linda Vorvick, MD: Family Physician, Department of Family Medicine, University of Washington School of Medicine

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