**Supplemental Materials X: Summary of initial Consolidated Framework for Implementation Research (CFIR) in the Medical Intensive Care Unit and Cardiovascular Intensive Care Unit, Choosing Wisely project to reduce unnecessary chest x-rays, November 2015 - January 2016.**

| **Intervention Characteristic1** | **Observations from the MICU** | **Observations from the CVICU** | **Hypothesized barriers (modified)2** | **Possible Interventions** |
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| **Intervention Characteristics** | | | | |
| *Intervention source* (externally vs. internally developed) | Externally developed. | Externally developed but with internal input from peer champions. | External development (partially modifiable). | Increase role of peer champions in MICU. |
| *Evidence strength and quality* (stakeholder perception of evidence) | Attendings, critical care (CC) fellows, and nurse practitioners (NPs) familiar with evidence. Residents less aware. | CC attendings and NPs familiar with and agree with evidence. CVICU surgeons less aware. Some concerns regarding whether subpopulation of patients might benefit from daily CXRs. | Need for increased awareness of the initiative (modifiable). | Improve education and promotional campaign (finalize flyers addressing frequent misperceptions of CXR ordering). |
| *Relative advantage* (perceived advantage of intervention vs. alternative) | NPs and CC fellows endorse value of eliminating unnecessary CXRs. Residents and medical students believe other high-value care projects (e.g., eliminating unnecessary CTs) would have greater impact. | NPs and CC attendings acknowledge value of eliminating unnecessary CXRs from both patient and provider perspectives. | Relative advantage (not modifiable). |  |
| *Adaptability* (extent to which intervention can be adapted to meet local needs) | No problems identified. | NPs indicated on-demand strategy less feasible for lung-transplant or VAD patients, suggested targeting patients >3 days s/p valve surgery. |  | In CVICU, focus initiative on "less complicated" patients (i.e., patients s/p valve surgery >3 days rather than lung transplant patients). |
| *Complexity* (perceived difficulty of implementation ) | Not considered difficult or time-consuming. | Not considered difficult or time-consuming. One NP suggested incorporating quick discussions on CXR ordering into rounds. |  | Incorporation of brief discussion on CXR ordering into rounds to ensure team members agree with decision to discontinue daily ordering. |
| *Cost* (costs associated with implementation, including investments, supply, human resources) | Opportunity cost (time required to think) is minor concern. | Opportunity cost (time required to think or reflect) is minor concern. |  |  |
| **Outer Setting** | | | | |
| *Peer pressure* (pressure to implement to keep pace with peers) | None noted. | Peer champions noted to influence other NP providers ordering decisions, particularly after discussions on rounds. |  | Continued promotion of healthy competition. |
| *External policy and incentives* (strategies to spread interventions) | CC fellows did not endorse a specific goal. No pay-for-performance incentive. | NPs discussed setting goals but no agreement about target. No pay-for-performance incentive. | Need for clear goals (modifiable). | Meet with key stakeholders to set ordering goals. |
| **Inner Setting** | | | | |
| *Structural characteristics* (social architecture, age, size, etc.3) | At unit level (MICU), hierarchical structure (attending, CC fellow, residents, intern). NP service less hierarchical. Of note, NPs, attendings, and CC fellows appear to have greater ownership over the unit ("feeling that it's mine") compared to residents. | Hierarchical structure (NP and CC attending). Unclear role of consulting surgeon in decision-making on rounds (some surgeons more proactive and assertive). | Hierarchical structure, decreased ownership in MICU due to rotating residents (partially modifiable). | Solicit feedback with peer champions and key stakeholders on ways to increase resident ownership of CXR ordering. |
| *Implementation climate* (capacity for change and extent to which intervention will be supported or rewarded within the institution) | CC fellows interested in and excited by QI projects. Medical residents and interns much less so, citing fatigue and competing priorities. Overall, individuals do not believe efforts to reduce CXRs will be rewarded. | CC attendings open to change. NPs excited about high-value care and QI projects and believe efforts to reduce ordering will be rewarded. Difficult to evaluate perceptions of consulting surgeons. | In MICU, resident fatigue and competing priorities (not modifiable). |  |
| *Tension for change* (degree to which stakeholders perceive current situation as needing change) | Little tension for change. NPs, in particular, do not believe over-ordering is problematic, citing low rates on their service and use of ultrasound instead of CXRs. | General agreement that too many CXRs are ordered. | Lack of knowledge of baseline ordering in MICU (modifiable). | Increase awareness of baseline CXR ordering rates in the MICU. |
| *Compatibility* (tangible fit between meaning and values attached to the intervention by involved individuals and how the intervention fits with existing workflows and systems) | Residents noted that weekly data feedback emails are easily ignored. CC fellows suggested that monthly CXR ordering rates be provided, as variation among patients makes weekly data difficult to interpret. | NPs also suggested monthly CXR ordering rates in weekly data feedback emails. Regarding workflow, NPs noted that lapses in communication between shift changes resulted in CXRs or other tests being ordered in a situation when they were not necessary. | Ignored weekly emails (partially modifiable). | In MICU, short meetings between peer champions (or CC fellows) to discuss CXR ordering and "give face" to weekly emails. In CVICU, potential policy to discuss CXR ordering at sign-out. |
| *Relative priority* (individuals' perception of the importance of implementation) | Ordering fewer CXRs and cost-containment initiatives not considered as important as patient care. Sentiment appears more common among residents than CC fellows, NPs, attending, etc. | Not the considered the unit's top priority but regarded as an area for improvement. | In MICU, resident fatigue and competing priorities (not modifiable). |  |
| *Organizational incentives and rewards* (extrinsic incentives such as goal-sharing awards, performance reviews, promotions, etc.). | None. | None. |  |  |
| *Goals and feedback* (degree to which goals are clearly communicated, acted upon, and fed back to staff) | Many residents ignore the weekly emails due to competition priorities, "email fatigue," and because they weren't associated with "a face." Didactic sessions perhaps were too remote to the intervention. | No obvious problems. | Ignored weekly emails (partially modifiable) and lack of knowledge of baseline ordering in MICU (modifiable). | In MICU, short meetings between peer champions (or CC fellows) to discuss CXR ordering and "give face" to the weekly emails. |
| *Learning climate* (climate in which 1. leaders express their own fallibility and need for input; 2. team members feel they are essential and valued; 3. individuals feel psychologically safe to try new methods; and 4) there is sufficient time and space for reflective thinking and evaluation). | Hierarchy unit may impact ordering decisions. Due to length of rounds, discussions are typically reserved for teaching rather evaluating necessity for common labs and tests. Overall, busy unit provides little time for reflection. | Not considered a teaching unit, as resident teams are not present and students rarely rotate through the CVICU. | Busy rounds and competing priorities (partially modifiable). | To complement education goals, CW might encourage residents and attendings to discuss high-value care principles in daily resident education sessions. |
| *Leadership engagement* (commitment, involvement, and accountability of leaders) | Need for greater involvement of MICU leaders. | Good leadership involvement with CVICU medical director. | MICU leadership needs (modifiable). | Meet with MICU leadership. |
| *Access to knowledge and information* (ease of access to digestible information and knowledge about the intervention) | Limited. | Limited. | Need for increased awareness (modifiable). | Finalization of additional promotional materials (CXR flyer with frequent misperceptions and summary of available literature). |
| **Characteristics of Individuals** | | | | |
| *Knowledge and beliefs about intervention* (individuals' attitudes and toward and value placed on the intervention as well as familiarity with facts, truth, and principles related to the intervention) | Attitudes and knowledge vary greatly. Some residents said they do not have time; CC fellows and NPs believe in the intervention's importance. | CC attendings and NPs familiar with facts and principles related to the intervention. Perceptions of the surgeons are less clear. | Need for increased awareness of initiative (modifiable). | Finalization of additional promotional materials (CXR flyer with frequent misperceptions and summary of available literature). |
| *Self efficacy* (individuals belief in their own capability to execute actions to achieve implementation goals) | Not entirely clear but hierarchy and learning environment likely contribute to varying degrees of self-efficacy among team members. Compared to residents, NPs noted to have greater efficacy. | NPs confident in management and CXR ordering decisions, despite occasionally deferring to attendings. |  |  |
| *Individual identification with organization* ( individuals' perception of the organization and their commitment to it) | Attendings, CC fellows, NPs have greater buy-in and identify more with the unit. Residents rotating through the unit appear less invested. | NPs and CC attendings appear invested in the CVICU and in Choosing Wisely. Difficult to evaluate their investment in VUMC. | In MICU, lack of ownership (partially modifiable). | To complement education goals, CW might encourage residents and attendings to discuss high-value care principles in daily resident education sessions. |
| **Process** | | | | |
| *Planning* (degree to which a plan for implementing an intervention is developed in advance and the quality of the plan) | Plan sound overall, but delayed dissemination of flyer summarizing evidence identified as an error in planning. | Plan sound overall, but delayed dissemination of flyer summarizing evidence identified as an error in planning. | Need for increased awareness of initiative (modifiable). | Finalization of additional promotional materials (CXR flyer with frequent misperceptions and summary of available literature). |
| *Engaging* (attracting and involving appropriate individuals in the implementation) | Need greater involvement of MICU leaders. | No obvious problems. | MICU leadership needs (modifiable). | Meet with MICU leadership. |
| *Champions* (individuals who dedicate themselves to supporting, marketing, and driving through an implementation) | Unclear perception of peer champions in the MICU. Resident peer champions are on other rotations and lack face time with the initiative. | Peer champions in the CVICU are also providers in the unit and provide strong leadership. |  |  |
| *Reflecting and evaluating* (feedback about the process and quality of implementation accompanied with regular personal and team debriefing about progress and experience) | Limited reflection and evaluation on rounds, and no formal meeting yet held to discuss initiative with key stakeholders. | Reflection and evaluation noted on rounds but no formal meeting yet held to discuss initiative with key stakeholders. | Lack of formal evaluation mechanism at unit level (modifiable). | Arrange progress meetings with key stakeholders in both units to discuss progress and next steps. |

1. The Consolidated Framework for Implementation Research consists of 39 constructs, not all of which are included in this table. Descriptions of individual constructs are adapted from the CFIR itself, available at <http://cfirguide.org/constructs.html>
2. Team members classified barriers as modifiable, partially modifiable, or not modifiable
3. In evaluating constructs related to inner setting, we chose to assess the "organization" at the level of the care unit (MICU) rather than at the level of Department of Medicine or Vanderbilt University Medical Center (VUMC)