## Supplementary material S2: The modified HFACS framework applied to serious incident reports

The Table below includes description of the main categories of contributory factors at each tier of the modified HFACS framework. Column 2 outlines the differences from the HFACS framework devised by Diller et al.15

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| **Contributory factors within each tier of the Modified HFACS framework** | **Changes compared to HFACS framework by Diller et al** |
| **Unsafe Actions or Errors**  **Errors**   * **Decision-based errors**: Actions of staff proceeded from intention but were subsequently found not to have been appropriate for the situation. Examples include inadequate assessment, inadequate management plan, cognitive bias. * **Skill (action)-based errors:** Unintentional slips and lapses made during the execution of seemingly familiar tasks.   Examples include miscalculation of early warning scores, omitted steps in procedure, documentation errors.   * **Perceptual errors:** Errors which occur when sensory input is degraded. Examples include misreading information, observational errors.   **Violations**   * **Routine violations:** Practices that had become routinised as workarounds (bending the rules) and seemed to be acceptable or done by peers in the same environment. Examples include not following policies, poor documentation practices. * **Exceptional violations**: One-off departures from accepted practice, which would generally not be acceptable by peers and seniors. Examples include failures to carry out critical job responsibilities, take necessary safety precautions. | No changes  No changes |
| **Preconditions for unsafe acts**   * **Communication factors:** Issues with communication related to problems with the *content* of the information exchanged, not involving the right individuals or if the outcome of the exchange of information was not achieved. * **Team dynamics:** How a team worked together and provided support to each other, under the guise of appropriate leadership * **Environmental factors:** Three different factors relating to the environment within which staff operated are identified: physical (characteristics of the setting where care is delivered), technological and local cultural environment. * **Patient factors:** Factors relating to the patient’s case (such as complexity, communication barriers) * **Staff well-being and preparedness for work:** Situations where the operator is incapable to perform the task required due to adverse mental or physical health. This category also includes how ready staff is to work (fitness for duty) | Diller et al. divides preconditions for unsafe acts into three categories (personnel, environmental, condition of operator).  Personnel factors include issues relating to communication, coordination and planning and problems relating to the readiness of staff to carry out their duties.  Local (departmental) cultural factors are not present at this level in Diller et al.’s model.  Equipment design falls under “organisational influences” in Diller et al.’s model.  Patient factors are not present in Diller et al.’s model.  Fitness for duty falls under “personnel factors” in Diller et al.’s model. |
| **Supervisory factors**   * **Inadequate oversight:** Not providing adequate training to juniors or the right level of professional guidance. * **Inadequate planning:** inadequacy of how the delivery of care was routinely organised, including the creation, enforcement and communication of local policies. * **Supervisory violations:** Intentional departures from expected practice * **Failure to address a known problem:** Hazard previously identified has not been addressed by local leadership team. | No changes  Diller et al.’s framework does not include creation of local policies at this level.     No changes.  No changes |
| **Organisational influences**   * **Poor operational processes**: These are issues with how things are meant to happen within an organisation. They include inadequate *operations* (structured systems in place to deliver care), *inadequate procedures* (such as standard operating procedures) and the *oversight* of safety within an organisation. * **Resource management:** Factors relating to human and financial resources and hardware availability for adequate functioning of an organisation. * **Organisational culture:** The unspoken rules and habits governing how things get done within an organisation | Diller et al. does not include issues with organisational policies here.  No changes.  Diller et al. label this factor as “organisational climate” and it covers both organisational culture and policies in place. |
| **Extra-organisational issues**   * Issues identified at this level correspond to problems which are beyond the remit of the organisation investigating the incident. Some may have been identified as “preconditions for unsafe acts”. Examples include issues with product design, financial constraints from local commissioning bodies | Not identified in Diller et al. |

Description of different levels of contributory factors in the modified HFACS framework and comparison with the HFACS framework devised by Diller et al.