Supplementary File 1

MCDA questionnaire used for expert consultation

This questionnaire was developed specifically for the present study and has not been published elsewhere. It was used to support two rounds of expert consultation for prioritizing feasible nursing measures for central venous catheter infection prevention in a neurosurgical intensive care unit.

Instructions for experts

- Please review each candidate nursing measure according to the listed evaluation criteria.
- For each criterion, rate the measure on a 5-point scale, where 1 = very low or not appropriate and 5 = very high or highly appropriate.
- Please provide comments or suggested revisions when a score is 3 or lower.
- In the weighting section, please assign a relative weight to each criterion. The total weight across all criteria should equal 100%.

Part A. Expert background information

Item	Response	Comments
Expert code		
Professional role		
Department or specialty		
Professional title		
Years of clinical or nursing-management experience		
Experience in central venous catheter care or infection prevention		
Experience in evidence-based nursing or guideline implementation		

Part B. MCDA criteria weighting

Please rate the importance of each criterion and assign a weight. The sum of all weights should be 100%.

Criterion	Description	Importance score (1-5)	Weight (%)
Expected clinical benefit	Potential to reduce CVC-related infection indicators or improve patient safety.		
Alignment with evidence-based recommendations	Consistency with published guidelines, consensus documents, or high-quality evidence.		
Feasibility in the neurosurgical ICU	Practicality under local staffing, workflow, equipment, and patient-		

	care conditions.		
Nursing workload	Additional workload and complexity for bedside nursing implementation.		
Training requirements	Amount of staff education, competency assessment, and supervision required.		
Resource availability	Availability and affordability of required materials, devices, and institutional support.		

Part C. Candidate nursing measures to be prioritized

Please score each candidate measure against the MCDA criteria. A higher score indicates stronger support for inclusion in the final intervention package.

Candidate measure	Clinical benefit	Evidence alignment	Feasibility	Workload	Training	Resources	Comments
Use sterile transparent and breathable dressings to cover the puncture site; replace every 7 days or immediately if damp, curled, detached, contaminated, or associated with fluid accumulation.							
Perform positive-pressure pulsatile flushing and locking using prefilled sterile normal saline.							
Standardize replacement of external CVC tubing and three-way stopcocks according to infusion type, including							

replacement after 24 hours for parenteral nutrition tubing.							
Disinfect catheter hubs and ports with alcohol before medication injection and allow them to dry completely; replace ports immediately if blood stains or contamination are observed.							
Consider prophylactic antimicrobial lock therapy for selected long-term catheterization patients with recurrent catheter-related bloodstream infection, based on microbiological evidence and clinical judgment.							
Strengthen daily assessment of puncture-site condition and systemic signs of infection.							
Reinforce hand hygiene and aseptic technique during catheter manipulation.							
Assess catheter necessity daily and recommend timely removal							

when the catheter is no longer clinically required.							

Part D. Overall recommendation

Question	Response	Comments
Which measures should be included in the final nursing intervention package?		
Are any candidate measures unsuitable for routine implementation in this neurosurgical ICU?		
Are any important CVC infection-prevention measures missing from the candidate list?		
What additional training or workflow support is required for implementation?		

Part E. Round 2 confirmation

After Round 1, the study team summarized expert scores and comments. Experts were asked to review the revised candidate list, confirm whether the prioritized measures were appropriate for inclusion, and provide final comments on feasibility and implementation details.

Final candidate measure	Accept	Revise	Final comments
Use sterile transparent and breathable dressings to cover the puncture site; replace every 7 days or immediately if damp, curled, detached, contaminated, or associated with fluid accumulation.			
Perform positive-pressure pulsatile flushing and locking using prefilled sterile normal saline.			
Standardize replacement of external CVC tubing and three-way stopcocks according to infusion type, including replacement after 24			

hours for parenteral nutrition tubing.			
Disinfect catheter hubs and ports with alcohol before medication injection and allow them to dry completely; replace ports immediately if blood stains or contamination are observed.			
Consider prophylactic antimicrobial lock therapy for selected long-term catheterization patients with recurrent catheter-related bloodstream infection, based on microbiological evidence and clinical judgment.			

CVC = central venous catheter; MCDA = multi-criteria decision analysis.