

EDUCATIONAL AND SELF-MANAGEMENT STRATEGIES FOR PREVENTING CATHETER-ASSOCIATED URINARY TRACT INFECTION IN HOME CARE: A STRUCTURED NARRATIVE REVIEW

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ARTICLE INFO

Article history:

Received: 13-08-2026

Revised: 05-09-2026

Accepted: 16-09-2026

Available online: 27-09-2026

Kata Kunci:

Infeksi Saluran Kemih Terkait Kateter, Kateter Urin Menetap, Keperawatan Rumah, Pendidikan Kesehatan, Pengasuh Keluarga

Keywords:

Catheter-Associated Urinary Tract Infection, Family Caregivers, Health Education, Home Care Nursing, Self-Management

ABSTRAK

Kateter urin menetap jangka panjang semakin banyak dikelola di rumah, tetapi sebagian besar pedoman pencegahan infeksi saluran kemih terkait kateter dikembangkan untuk rumah sakit dan fasilitas perawatan jangka panjang. Tinjauan ini bertujuan mensintesis bukti mengenai edukasi berpusat pada keluarga, edukasi pengasuh, dan strategi manajemen diri dalam mencegah infeksi serta mengurangi pemanfaatan layanan kesehatan pada orang dewasa dengan kateter urin menetap jangka panjang di rumah. Tinjauan naratif terstruktur dilakukan melalui penelusuran PubMed, ScienceDirect, Google Scholar, dan Garuda pada September 2026. Literatur yang dikaji mencakup publikasi periode 2014–2026, dengan sintesis tematik berdasarkan kedekatan bukti. Sebanyak 23

sumber dianalisis yang terdiri atas pedoman klinis, regulasi, uji intervensi, studi observasional, dan tinjauan literatur. Hasil sintesis menghasilkan empat domain utama, yaitu edukasi pasien dan caregiver, self-management dan self-monitoring, intervensi multikomponen berbasis organisasi, serta tantangan implementasi pada layanan komunitas dan lingkungan dengan keterbatasan sumber daya. Tidak ditemukan uji klinis yang secara langsung mengevaluasi edukasi caregiver keluarga untuk perawatan kateter di rumah. Uji manajemen diri berbasis rumah terbesar melibatkan 202 peserta dan menunjukkan penurunan kejadian sumbatan kateter dalam enam bulan pertama, tetapi tidak menunjukkan penurunan infeksi terkait kateter. Edukasi berbasis keluarga didukung oleh pedoman, namun bukti empiris langsung masih terbatas. Pelatihan terstruktur menggunakan metode teach-back, perencanaan pulang, dan tindak lanjut keperawatan komunitas perlu dievaluasi lebih lanjut dalam penelitian mendatang.

ABSTRACT

Long-term indwelling urinary catheters are increasingly managed in home settings, yet most catheter-associated urinary tract infection prevention guidelines were developed for hospitals and long-term care facilities. This review aimed to synthesize evidence regarding family-centered education, caregiver education, and self-management strategies for preventing infection and reducing healthcare utilization among adults with long-term indwelling catheters at home. A structured narrative review was conducted through searches of PubMed, ScienceDirect, Google Scholar, and Garuda in September 2026. The reviewed literature covered publications from 2014 to 2026, and evidence was synthesized using thematic analysis based on evidence proximity. Twenty-three sources were included, consisting of clinical guidelines, regulations, intervention trials, observational studies, and literature reviews. The synthesis identified four main domains: patient

and caregiver education, self-management and self-monitoring, multicomponent organizational interventions, and implementation challenges in community and resource-constrained settings. No clinical trials directly evaluated family caregiver education for home catheter care. The largest home-based self-management trial involved 202 participants and demonstrated reduced catheter blockage during the first six months, although no significant reduction in catheter-associated urinary tract infection was observed. Family-centered education is supported by guidelines; however, direct empirical evidence remains limited. Structured training using the teach-back method, discharge planning, and community nursing follow-up should be further evaluated in future research.

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INTRODUCTION

Indwelling urinary catheters are among the most commonly used medical devices, and a substantial proportion of long-term users now live in the community rather than in hospitals. Bacterial colonization of the catheterized urinary tract is close to inevitable: the daily incidence of bacteriuria with an indwelling catheter is approximately 3% to 7%, and most patients with long-term catheters are bacteriuric at any given time (Gould et al., 2010; Hooton et al., 2010; Nicolle, 2014). Catheter-associated urinary tract infection (CAUTI), defined by the presence of symptoms or signs compatible with infection in a catheterized patient with significant bacteriuria, is therefore a persistent risk rather than an occasional event and is accompanied by other catheter complications such as blockage, encrustation, leakage, and accidental dislodgement (Hooton et al., 2010; Nicolle, 2014).

Home health care (HHC) presents particular difficulties for infection prevention. A systematic review of infections in HHC found reported infection rates ranging from 5% to 80%, reflecting heterogeneous populations and definitions (Shang et al., 2014). Using national Outcome and Assessment Information Set data from the United States, Shang et al. (2015) found that 3.5% of HHC patients were hospitalized or received emergency care because of an infection that developed during HHC, with urinary tract infection among the leading types. Among 28,205 catheterized HHC patients served by 473 agencies, hospital transfers due to urinary tract infection accounted for roughly 15% of all hospital transfers; the mean patient age was 80.5 years, and 72.9% lived with at least one other person (Harrison et al., 2022). This distribution suggests that family members or co-residents are often available and may participate in daily catheter care.

Unlike hospital and nursing home settings, the home offers no continuous professional oversight. Nursing visits are intermittent, and between visits the tasks of emptying the drainage bag, maintaining an unobstructed closed system, performing perineal hygiene, and recognizing early warning signs fall to patients and informal caregivers. A mixed-methods systematic review of infection risk in older adults receiving

home care identified behavioral factors, including limited knowledge and suboptimal hygiene practices, alongside medical and individual risk factors (Liljas et al., 2025). A 2026 scoping review of self-care among community-residing adults with indwelling catheters found that most of the 32 included documents concerned CAUTI prevention, but the evidence base consisted largely of qualitative studies, expert opinion, and guidelines rather than intervention trials (Schumacher et al., 2026).

Educational interventions directed at patients and families are therefore a strategy. However, the only large randomized trial of catheter self-management in community-living users did not demonstrate a significant reduction in CAUTI (Wilde et al., 2015), and a systematic review of patient and family engagement in CAUTI prevention concluded that most interventions were poorly described and inconsistently effective (Mangal et al., 2021). Major guidelines recommend educating patients and caregivers but were developed primarily for acute and facility-based care (Gould et al., 2010; Hooton et al., 2010; Loveday et al., 2014). In Indonesia, national infection prevention and control regulation is directed chiefly at health care facilities (Kementerian Kesehatan Republik Indonesia, 2017), while caregiving for dependent older adults at home is predominantly undertaken by family members.

This gap between what caregivers are asked to do and what is known about how best to prepare them motivates the present review. Its objectives were to categorize educational approaches used to prepare patients and families for long-term catheter care outside the hospital, summarize reported effects on CAUTI, catheter complications, and hospital use, identify implementation challenges relevant to community health, and derive practical recommendations for homecare and discharge planning, with particular attention to resource-constrained settings such as Indonesia.

METHODS

Review Design

A structured narrative review was conducted to synthesize evidence on educational, self-management, caregiver-engagement, and organizational strategies relevant to prevention of catheter-associated urinary tract infection among adults with long-term indwelling urinary catheters in home and community settings. A structured narrative approach was selected because directly relevant literature was limited and heterogeneous in population, intervention, setting, and outcome definitions, precluding meaningful quantitative pooling. The review used a predefined search strategy, explicit eligibility criteria, structured data extraction, and thematic synthesis. Evidence was categorized

according to directness to the review question so that findings from homecare studies were distinguished from evidence derived from nursing homes, hospitals, or general educational research.

Search Strategy

Searches were conducted in September 2026 in PubMed, ScienceDirect, Google Scholar, and Garuda (Garba Rujukan Digital) to identify international and Indonesian literature. The search combined terms for catheter-associated urinary tract infection, indwelling urinary catheters, home or community care, caregivers, education, patient engagement, self-management, teach-back, infection, and health care utilization. Reference lists of key publications were hand-searched. Relevant clinical practice guidelines and Indonesian infection-prevention regulations were also retrieved from their issuing bodies. Because the review was designed as a structured narrative review rather than a systematic review, database-specific result counts were not prospectively recorded and should not be interpreted as a PRISMA systematic-search yield.

Eligibility Criteria

Sources were eligible when they addressed adults with indwelling urethral or suprapubic catheters used in community, homecare, or long-term-care settings; evaluated or described an educational, self-management, engagement, implementation, or policy intervention relevant to catheter maintenance; or provided guideline or epidemiological evidence necessary to contextualize prevention. Evidence on teach-back was included when it provided generalizable information about educational delivery. Publications from 2014 to 2026 were prioritized, while earlier landmark guidelines were retained when still relevant to current practice. Studies limited to short-term perioperative catheterization, intermittent self-catheterization only, or pediatric populations were excluded from the core evidence synthesis, although educational-development studies were retained when they informed intervention design. Evidence from nursing homes, hospitals, or general chronic-disease education was treated as indirect or contextual evidence rather than as direct evidence of effectiveness in private-home settings.

Evidence Classification and Data Extraction

For each included source, the study design, population, setting, intervention or exposure, comparator where applicable, outcomes, principal findings, and limitations were extracted. Sources were classified as (1) direct evidence, when the study involved adults with long-term indwelling catheters in home or community settings; (2) near-direct evidence, when it addressed catheter self-management or home-health systems but did not directly test family caregiver education; and (3) contextual evidence, when it came from

nursing homes, hospitals, or general educational interventions. This classification was used to prevent indirect findings from being presented as proof of effectiveness in homecare. Titles and abstracts were screened by the first author; eligibility decisions and extracted data were independently verified by the second author, and disagreements were resolved through discussion.

Synthesis

Findings were synthesized thematically around four domains: patient and caregiver education; self-management and self-monitoring; multicomponent and organizational interventions; and implementation considerations for community and resource-constrained settings. Particular attention was given to CAUTI, catheter complications, health care utilization, caregiver knowledge and skills, and feasibility. No quantitative meta-analysis was undertaken because of substantial heterogeneity in interventions, settings, and outcome definitions. No formal risk-of-bias scoring or GRADE certainty assessment was performed; instead, study design and major limitations were explicitly considered in the narrative interpretation.

RESULTS AND DISCUSSION

Table 1. Key studies informing family-centered and self-management education for home catheter care

Author (Year)	Design and Setting	Population and Intervention	Key Findings Relevant to This Review
Wilde et al. (2015)	RCT; community, USA	202 adults with long-term indwelling catheters; home-based self-management training	Blockage decreased during the first 6 months ($p = .02$), but not thereafter; no significant effect on CAUTI or dislodgement.
Mody et al. (2015)	Cluster RCT; 12 nursing homes, USA	Barrier precautions, surveillance feedback, staff education, and hand hygiene	Reduced clinically defined CAUTI and multidrug-resistant organism prevalence.
Mody et al. (2017)	National implementation ; 404 nursing homes, USA	Technical and socio-adaptive bundles including resident/family engagement	Adjusted CAUTI incidence fell from 6.42 to 3.33 per 1,000 catheter-days.
Harrison et al. (2022)	Agency survey linked to OASIS/Medicaid; USA	28,205 catheterized HHC patients; written catheter policies	Both policies were associated with a 21% lower adjusted probability of UTI-related hospital transfer.

Mangal et al. (2021)	Systematic review; mostly hospitals	12 patient/family engagement studies	Handouts and verbal education predominated; fewer than half showed significant improvement.
Schumacher et al. (2026)	Scoping review; community	32 documents on self-care of adults with indwelling catheters	81.3% addressed CAUTI; evidence was dominated by qualitative studies, expert opinion, and guidelines.
Talevski et al. (2020)	Systematic review; mixed settings	20 studies of teach-back	Teach-back was effective in 19 of 20 studies, but none addressed urinary catheter care.
Mittal et al. (2025)	RCT; tertiary hospital, India	346 inpatients; clean versus sterile catheter care	CAUTI: 7.5% versus 6.9%, respectively ($p = .83$).

Characteristics of the Evidence

Twenty-three sources were included in the synthesis, comprising clinical guidelines and regulations, intervention trials, observational studies, and reviews; the key studies are summarized in **Table 1**. Evidence was heterogeneous and was therefore interpreted according to directness to the review question. Direct home or community evidence included the randomized self-management trial and home-health agency data; near-direct evidence included catheter self-management and implementation studies; contextual evidence included nursing-home CAUTI programs, hospital-based catheter-care research, and general teach-back literature. Most intervention evidence originated from high-income countries, particularly the United States, and no controlled trial of family caregiver education for home catheter care conducted in Indonesia was identified.

From Written Instructions to Interactive Education

Written discharge materials and verbal instruction remain the dominant formats for patient and family engagement, but the available evidence is predominantly indirect and is not sufficient to establish that these approaches prevent CAUTI in homecare. In the systematic review by Mangal et al. (2021), flyers or handouts were used in 83.3% of included interventions and verbal education in 58.3%; fewer than half of interventions demonstrated statistically significant improvement in measured outcomes, and intervention reporting was often insufficient for replication. The implication is not that written education is ineffective, but that information provision alone has not been adequately demonstrated as a CAUTI-prevention strategy.

Interactive methods offer a plausible remedy. Teach-back, in which the learner explains or demonstrates in their own words what they have been taught and the educator

corrects misunderstandings until comprehension is confirmed, was effective in 19 of 20 studies in a systematic review, with benefits ranging from knowledge recall and retention to objective outcomes such as hospital readmission and quality of life (Talevski et al., 2020). An earlier JBI systematic review similarly found that teach-back improved adherence and self-management in people with chronic disease (Ha Dinh et al., 2016). However, definitions and delivery of teach-back vary considerably across studies (Shersher et al., 2021), and none of the included teach-back studies addressed urinary catheter care. The evidence therefore supports teach-back as a general educational technique rather than as a proven CAUTI-prevention strategy.

Self-Management and Self-Monitoring Interventions in the Home

The most rigorous home-based evidence comes from the program of research led by Wilde and colleagues. In a randomized trial of 202 community-living adults with long-term indwelling catheters, the intervention consisted of self-monitoring and self-management skills taught during two home visits by a study nurse in the first month, a telephone call at two months, and a booster visit at four months; the control group received usual care (Wilde et al., 2015). The intervention significantly reduced reported catheter blockage during the first six months ($p = .02$), but the effect did not persist, and there were no significant effects on catheter-related urinary tract infection or dislodgement. Both groups improved over 12 months, which the authors attributed partly to a simple catheter-problems calendar and bimonthly interviews that may have acted as a modest self-monitoring intervention in the control arm as well. A subsequent analysis tested a model of fluid-intake self-management within this cohort (Wilde et al., 2016).

The trial shows that education alone should not be assumed to prevent CAUTI. Low-intensity self-monitoring may be useful, while the time-limited effect on blockage suggests a need for reinforcement. Importantly, the trial targeted catheter users rather than family caregivers, for whom comparable controlled evidence was not identified.

Multicomponent Programs with Patient and Family Engagement

Stronger evidence of infection reduction comes from multicomponent programs in nursing homes, where education is embedded within a broader system of care. In the Targeted Infection Prevention cluster-randomized trial conducted in 12 Michigan nursing homes, a program of preemptive barrier precautions, active surveillance with feedback, and interactive staff education with hand hygiene promotion reduced clinically defined CAUTI and multidrug-resistant organism prevalence among residents with indwelling devices (Mody et al., 2015). Building on this, the national implementation project within the AHRQ Safety Program for Long-Term Care combined a technical bundle with a socio-adaptive

bundle emphasizing leadership, communication, and resident and family engagement. Across 404 community-based nursing homes, adjusted CAUTI incidence fell from 6.42 to 3.33 per 1,000 catheter-days even though catheter utilization did not change (Mody et al., 2017). A qualitative assessment highlighted the role of infection preventionists and a resident-safety culture in sustaining these changes (Krein et al., 2017), and an economic evaluation of a CAUTI prevention program in nursing homes has also been published (Hutton et al., 2018).

These programs are relevant to homecare mainly because education was embedded within standardized processes, feedback, and organizational support. Family engagement was only one component, so its independent effect cannot be isolated.

Organizational Policies in Home Health Agencies and Hospital Transfers

Evidence from HHC agencies points in the same direction. In a nationally representative study linking an agency survey to OASIS and Medicare inpatient data, Harrison et al. (2022) examined whether agencies had written policies for replacement of indwelling catheters and for emptying the drainage bag. The probability of hospital transfer due to urinary tract infection during a 60-day HHC episode was 5.62% in agencies with neither policy and 4.43% in agencies with both, corresponding to a 21% lower probability after adjustment ($p < .05$). Although cross-sectional and unable to establish causation, this finding is directly relevant to the review question: drainage-bag management is typically performed by patients or family members between nursing visits, and an agency policy is a mechanism through which consistent caregiver instruction can be delivered and audited.

Digital and Telehealth-Supported Education

Digital education was not well represented. No controlled study evaluating digital or telehealth education for family caregivers of adults with long-term indwelling catheters, with CAUTI or hospital use as an outcome, was identified. Related work includes a co-designed pediatric CAUTI educational resource (Mangal et al., 2022) and spaced eLearning for nurses (Alex et al., 2025). Digital tools therefore remain promising but untested for home catheter infection outcomes.

Core Content of Caregiver Education

Because intervention trials are few, the content of caregiver education must largely be derived from guidelines. Recommendations consistent across HICPAC, IDSA, and epic3 guidance include hand hygiene before and after any manipulation of the catheter or drainage system; maintaining a closed drainage system; keeping the catheter and tubing free of kinks; keeping the drainage bag below the level of the bladder and off the floor; emptying the bag regularly using a clean container and avoiding contact between the

drainage spout and the container; and routine meatal hygiene during daily bathing rather than cleansing with antiseptics (Gould et al., 2010; Hooton et al., 2010; Loveday et al., 2014). Guidelines also advise against routine catheter changes at fixed intervals and routine bladder irrigation for infection prevention, recommending instead that catheters be changed based on clinical indications such as infection, obstruction, or a compromised closed system (Gould et al., 2010; Hooton et al., 2010). Education should also help families distinguish asymptomatic bacteriuria, which generally should not be treated, from symptomatic infection, and recognize warning signs such as fever, rigors, new confusion, flank or suprapubic pain, and reduced or absent urine drainage, which warrant prompt professional contact (Hooton et al., 2010; Nicolle, 2014).

The question of sterile versus clean technique is especially relevant to family caregivers. Guidelines describe maintenance care in terms of clean rather than sterile practice (Gould et al., 2010; Hooton et al., 2010). A recent randomized trial of 346 hospitalized patients in India found CAUTI in 7.5% of patients receiving clean catheter care and 6.9% of those receiving sterile care ($p = .83$) (Mittal et al., 2025). Although conducted in hospital with short follow-up, this result supports teaching families a clean, feasible routine rather than a sterile procedure that they cannot reliably reproduce at home with limited supplies.

Caregiver Burden, Literacy, and Confidence

Family caregivers of catheterized patients are commonly older adults themselves, may have limited health literacy, and often manage multiple care tasks simultaneously. Education that relies on written materials disadvantages those with limited literacy, and the heterogeneity of teach-back practice (Shersher et al., 2021) means that simply instructing staff to use teach-back does not guarantee effective use. The finding that the effect of self-management training on blockage waned after six months (Wilde et al., 2015) also suggests that caregiver competence, like any skill, can erode without reinforcement. Caregivers' emotional burden, including embarrassment about intimate care and anxiety about causing harm, is rarely measured in intervention studies (Mangal et al., 2021; Schumacher et al., 2026).

Resource Disparities and Health System Context

The programs with the strongest evidence operated within well-resourced systems with dedicated infection preventionists, standardized data collection, and national coordination (Mody et al., 2015; Mody et al., 2017; Krein et al., 2017). Such infrastructure is uncommon in community care in low- and middle-income countries. Access to drainage bags, securement devices, clean water, and gloves may be inconsistent, and the interval

between professional contacts may be long. In Indonesia, infection prevention regulation focuses on health care facilities (Kementerian Kesehatan Republik Indonesia, 2017), and home visiting by community nurses through primary health centers varies in coverage and frequency between regions. Interventions designed in the United States may therefore require adaptation of content, delivery channel, and follow-up intensity before similar performance can be expected.

Measurement and Reporting

Outcome definitions vary from self-reported infection and clinically defined CAUTI to antibiotic use, emergency visits, and hospital transfer (Shang et al., 2015; Harrison et al., 2022; Wilde et al., 2015; Mody et al., 2017). Caregiver knowledge, skills, and self-efficacy are measured less often (Mangal et al., 2021). This heterogeneity limits comparison and identification of effective intervention components.

Evidence Gap and Research Priorities

The central evidence gap is the absence of adequately powered trials that isolate the effect of structured family caregiver education on CAUTI and health care utilization among adults managing long-term indwelling catheters at home. The strongest directly relevant trial tested patient self-management rather than caregiver-directed education and did not significantly reduce CAUTI (Wilde et al., 2015). Evidence from nursing homes suggests that education and family engagement may be useful components of multicomponent programs, but their independent effects cannot be isolated (Mody et al., 2015; Mody et al., 2017). Similarly, teach-back has demonstrated benefits in broader chronic-disease education but has not been tested specifically for catheter-related infection prevention (Talevski et al., 2020; Shersher et al., 2021). Future studies should use standardized CAUTI definitions, clearly specified educational components, competence-based outcomes, and clinically meaningful follow-up.

Practical Implications for Community and Public Health

Although evidence does not establish that family-centered education alone reduces CAUTI, it supports several low-risk, guideline-consistent recommendations.

First, integrate structured caregiver training into discharge planning. Before a patient is discharged with a long-term catheter, at least one designated family caregiver should receive hands-on training in bag emptying, hygiene, tubing management, and warning signs, using return demonstration and teach-back to confirm competence rather than relying on printed leaflets alone (Mangal et al., 2021; Talevski et al., 2020; Ha Dinh et al., 2016).

Second, teach a clean and feasible maintenance routine. Content should follow guidelines (Gould et al., 2010; Hooton et al., 2010; Loveday et al., 2014), emphasize hand hygiene and an unobstructed closed system, and explicitly discourage unsupported practices such as antiseptic meatal cleansing or routine irrigation, while remaining realistic about supplies available in the home (Mittal et al., 2025).

Third, provide a simple self-monitoring tool. A catheter diary or calendar recording urine appearance, flow problems, and symptoms is inexpensive and was associated with improvement in both arms of the home-based trial (Wilde et al., 2015).

Fourth, schedule reinforcement. Education should be revisited during community nursing visits or by telephone in the months after discharge because the benefit of a front-loaded intervention appears to diminish over time (Wilde et al., 2015).

Fifth, embed education within organizational policy. Homecare providers, hospitals, and primary health centers should adopt written protocols for catheter maintenance and caregiver instruction, since agency-level policies were associated with fewer hospital transfers due to urinary tract infection (Harrison et al., 2022) and system-level programs have produced the largest reductions in CAUTI (Mody et al., 2017).

Sixth, generate local evidence. In Indonesia, pragmatic trials or well-designed quasi-experimental studies comparing structured caregiver training with usual discharge education, using standardized definitions of CAUTI and recording emergency visits and readmissions, are needed. Digital adjuncts such as short video modules or messaging-based reminders should be co-designed with families and evaluated rather than assumed to be effective (Mangal et al., 2022).

Limitations

This structured narrative review has several limitations. First, the search was conducted in four databases and may have missed relevant studies indexed elsewhere or unpublished implementation reports. Second, because this was not a systematic review, a PRISMA flow diagram, formal risk-of-bias tool, and GRADE assessment were not applied. Third, several sources came from nursing homes or hospitals rather than private homes, so their findings cannot be assumed to demonstrate effectiveness in family-managed homecare. Fourth, outcome definitions varied across studies, including self-reported infection, surveillance-defined CAUTI, antibiotic use, emergency visits, and hospital transfer. Finally, the limited number of directly relevant home-based intervention studies prevented quantitative pooling and limits the certainty of causal conclusions.

CONCLUSION

CAUTI and catheter-related complications remain important causes of health care utilization among adults living at home with long-term indwelling catheters, while family caregivers often perform much of the day-to-day maintenance. Current evidence indicates that written and verbal education is inconsistently effective, that a rigorous home-based self-management intervention reduced short-term catheter blockage but not CAUTI, and that the largest reductions in CAUTI have been observed in multicomponent, organizationally supported programs in which education and engagement are integrated with broader infection-prevention measures. Family-centered education should therefore be considered a component of a structured homecare system rather than a stand-alone CAUTI-prevention intervention. Future research should test structured caregiver training that incorporates competence-based teach-back or return demonstration, self-monitoring, planned reinforcement, and standardized outcome definitions, particularly in low- and middle-income settings including Indonesia.

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