

## Sigma's 29th International Nursing Research Congress

### Influence of Different Climates on the Replacement Time of Peripheral Intravenous Catheters: A Meta-Analysis

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**Background:** The newly conducted meta-analysis of the Cochrane database of systematic reviews has indicated that, compared to routine three-day replacement, clinically indicated replacement of peripheral intravenous catheters does not significantly increase the incidence of phlebitis. However, the literature included in that analysis did not compare subgroups of different climates. This induces the barriers of translating the evidence-based knowledge of clinically indicated peripheral intravenous catheter replacement as standard care in areas with warm and humid tropical/subtropical island climate like Taiwan.

**Purpose:** To explore the influence of different climates on the replacement time of peripheral intravenous catheters, through a systematic review and meta-analysis.

**Methods:** This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, and the methodology followed the Cochrane handbook. Six English and Chinese databases: Airiti Library, CINAHL, Cochrane Library, ProQuest, PubMed/MEDLINE, and the Index of the Taiwan Periodical Literature System were searched. For the search of the literature published prior to October 2017, Medical Subject Headings (MeSH) and synonymous keywords including "peripheral intravenous catheter\*", "peripheral IV catheter\*", "peripheral intravenous cannulation\*", or "peripheral intravenous device\*" and "replacement, re-site\*", or "indwell\*" were used. Adults and randomized controlled trials or controlled clinical trials were included. A total of nine articles met the criteria. The literature quality was assessed according to the Cochrane risk of bias 2.0 tool by independently two reviewers. The RevMan 5.3.5 software was used for the analysis of the different climate subgroups. The terrain and Köppen–Geiger climate classification was used to define the climate subgroups of tropical/subtropical island climate, temperate island climate, and temperate continental climate.

**Results:** The research quality of the nine included RCTs ranged from 4–5 points, according to the Cochrane RoB 2.0 tool. The Kappa value for consistency between the two reviewers was 0.965 ( $p < .0001$ ), indicating that the rating consistency of the reviewers was extremely high and that there was significant correlation. The results showed that the average indwelling time of catheters in the clinically indicated replacement group ranged from 84.53 hours to 109.4 hours, which indicated that, even for the clinically indicated replacement group, the average indwelling time was  $96 \pm 12$  hours.

The meta-analysis of the climate subgroups indicated that there was no significant difference in the incidences of phlebitis (risk ratio= 0.37, 1.44, 1.13;  $p = .21, .31, .15$ , respectively), local infection (risk ratio= 0, 0, 4.96;  $p = 1.00, 1.00, .30$ , respectively), bloodstream infection (risk ratio= 1.27, 0.00, 0.64;  $p = .71, 1.00, .63$ , respectively), and catheter occlusion (risk ratio= 0, 0.77, 1.19;  $p = 1.00, .69, .12$ , respectively) in the three climatic subgroups, between the clinically indicated replacement group and the routine three-day replacement group. Clinically indicated replacement can significantly reduce the medical material costs (five RCTs, 4747 participants,  $MD = -6.26$  AUD  $\approx 151.43$  new Taiwan dollars, 95% CI= [-7.06, -5.47],  $p < .00001$ ) and nursing time (two RCTs, 3424 participants,  $MD = -2.97$ mins, 95% CI= [-3.65, -2.29],  $p < .00001$ ) of peripheral intravenous catheter insertion.

**Conclusions/Implications for Practice:** Based on this systematic review and meta-analysis, clinically indicated replacement is the best, in terms of peripheral intravenous catheters. In areas with a warm, humid tropical/subtropical island climate, such as Taiwan, clinically indicated intravenous catheter

replacement can be considered if each shift change and random assessment shows no symptoms of infection in the insertion sites.

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**Title:**

Influence of Different Climates on the Replacement Time of Peripheral Intravenous Catheters: A Meta-Analysis

**Keywords:**

peripheral intravenous catheters, replacement and systematic review and meta-analysis

**References:**

Chen, T. W., Lin, H. C., Chang, C. M., & Fang, Y. H. (2015). The effect of duration of peripheral intravenous catheter (PIC) placement on peripheral thrombophlebitis. *Leadership Nursing, 16*(3), 69-87.

Rickard, C. M., McCann, D., Munnings, J., & McGrail, M. R. (2010). Routine resite of peripheral intravenous devices every 3 days did not reduce complications compared with clinically indicated resite: A randomised controlled trial. *BMC Medicine, 8*(1), 53-62. doi:10.1186/1741-7015-8-53

Rickard, C. M., Webster, J., Wallis, M. C., Marsh, N., McGrail, M. R., French, V., ... Whitby, M. (2012). Routine versus clinically indicated replacement of peripheral intravenous catheters: A randomised controlled equivalence trial. *The Lancet, 380*(9847), 1066-1074. doi:10.1016/S0140-6736(12)61082-4

Tuffaha, H. W., Rickard, C. M., Webster, J., Marsh, N., Gordon, L., Wallis, M., & Scuffham, P. A. (2014). Cost-effectiveness analysis of clinically indicated versus routine replacement of peripheral intravenous catheters. *Applied Health Economics and Health Policy, 12*(1), 51-58. doi: 10.1007/s40258-013-0077-2.

Van Donk, P., Rickard, C. M., McGrail, M. R., & Doolan, G. (2009). Routine replacement versus clinical monitoring of peripheral intravenous catheters in a regional hospital in the home program: A randomized controlled trial. *Infection Control and Hospital Epidemiology, 30*(9), 915-917. doi:10.1086/599776

Wang, W. N., & Kuo, C. C. (2014). The comparative efficacy of 96- and 72-hour replacement cycles for peripheral intravenous catheters: A randomized controlled trial. *Journal of Nursing and Healthcare Research, 10*(3), 190-198. doi:10.6225/JNHR.10.3.190

Webster, J., Clarke, S., Paterson, D., Hutton, A., van Dyk, S., Gale, C., & Hopkins, T. (2008). Routine care of peripheral intravenous catheters versus clinically indicated replacement: Randomised controlled trial. *BMJ: British Medical Journal (International Edition), 337*(7662), 157-160. doi:10.1136/bmj.a339

Webster, J., Lloyd, S., Hopkins, T., Osborne, S., & Yaxley, M. (2007). Developing a research base for intravenous peripheral cannula re-sites (DRIP trial). A randomised controlled trial of hospital in-patients. *International Journal of Nursing Studies, 44*(5), 664-671. doi:10.1016/j.ijnurstu.2006.02.003

Webster, J., Osborne, S., Rickard, C., & New, K. (2015). Clinically-indicated replacement versus routine replacement of peripheral venous catheters (Review). *Cochrane Database of Systematic Reviews, 8*, 1-36. doi: 10.1002/14651858.CD007798.pub4.

**Abstract Summary:**

This systematic review and meta-analysis included nine RCTs. The results showed that there was no significant difference in the risk ratio for phlebitis, local infection, bloodstream infection, and catheter

occlusion, between clinically indicated replacement and routine three-day replacement, in three different climate subgroups.

### **Content Outline:**

1. Background: Current evidence did not explore the influence of different climates on the replacement time of peripheral intravenous catheters. This induces difficult to translate evidence-based knowledge as clinically indicated peripheral intravenous catheter replacement as standard care in areas with a tropical/subtropical island climate.
2. Purpose: To explore the influence of different climates on the replacement time of peripheral intravenous catheters, through a systematic review and meta-analysis.
3. Methods:
  - 1) The methodology of systematic review and meta-analysis: Followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and the Cochrane handbook.
  - 2) The literature search strategy.
  - 3) The tool of quality appraisal: Using the Cochrane risk of bias assessment tool--RoB 2.0.
  - 4) The methodology of data extraction and data synthesis: Following the Cochrane handbook and using the Review Manager 5.3.5 software.
4. Results:
  - 1) Study characteristics: The climates of the study areas in the nine included RCTs were classified as tropical/subtropical island climate (two studies), temperate island climate (one study), and temperate continental climate (six studies).
  - 2) Study quality: 4–5 points, according to the Cochrane RoB 2.0 tool.
  - 3) Synthesis of results: There was no significant difference in the incidences of phlebitis, local infection, bloodstream infection, and catheter occlusion in the three climatic subgroups, between the clinically indicated replacement group and the routine three-day replacement group. Clinically indicated replacement can significantly reduce the medical material costs and nursing time of peripheral intravenous catheter insertion.
5. Conclusions/Implications for Practice: In areas with a warm, humid tropical/subtropical island climate, such as Taiwan, clinically indicated intravenous catheter replacement can be considered if each shift change and random assessment shows no symptoms of infection in the insertion sites.

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**Author Summary:** I am an advanced practice nurse of the emergency department at Chi-Mei Medical Center, Taiwan. My research interest is focused on evidence-based knowledge translation, systematic review and meta-analysis.