Public-access defibrillation in Japan: A time-dependent propensity score sequential matching

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Background : Earlier defibrillation is a key factor in improving survival outcomes in patients with out-of-hospital cardiac arrest (OHCA) due to ventricular fibrillation (VF). To implement early intervention, the use of public-access automated external defibrillators (AEDs) has been widespread worldwide. However, the timing of public-access defibrillation (PAD) has not been extensively investigated.

Methods : Using a nationwide, prospective, population-based OHCA registry in Japan between 2022 and 2023, we included consecutive bystander-witnessed VF of presumed cardiac origin with resuscitation attempts in public locations. OHCA patients who received PAD before emergency-medical-services (EMS) arrival were sequentially matched with patients at risk of receiving PAD on a minute-by-minute basis using time-dependent propensity scores to address resuscitation time bias. The primary outcome was one-month survival with favorable neurological outcome, defined as a cerebral performance category scale of 1 or 2.

Results : A total of 1,697 patients received PAD, while 2,141 patients who did not receive PAD were eligible for analysis. After sequential matching, 1,646 matched pairs were identified. The corrected risk ratio for one-month survival with favorable neurological outcome in the PAD group than in the non-PAD group was 1.72 (95% confidence interval: 1.58–1.88). The effect size by the timing of PAD were 1.55 (1.38–1.73) for 0–4 minutes, 1.80 (1.56–2.09) for 5–9 minutes, 1.90 (1.36–2.64) for 10–14 minutes, 2.42 (0.76–7.72) for 15–19 minutes, and 2.25 (0.53–9.56) after 20 minutes.

Conclusion : In Japan, PAD before EMS arrival showed a trend toward improved favorable neurological outcome throughout the entire time period among bystander-witnessed VF patients in public locations. These findings reinforce the need for further dissemination of AEDs in public locations as well as public measures that allow the general public to access AEDs more quickly.

Analysis of the Spatial Diffusion of the 6th Wave of COVID-19 in Japan Using SARS-CoV-2 Genomic Data

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Background : The Omicron variant, which is more transmissible than previous strains, spread rapidly beyond major urban areas and exhibited spatial patterns distinct from earlier waves. Its rapid expansion hindered contact tracing, leaving the spatial diffusion process poorly understood.

Objective : We aimed to clarify the spatial diffusion process of COVID-19 and to identify factors influencing it in Japan during the sixth wave (early 2022), which was firstly driven by the Omicron variant.

Methods : We applied discrete phylogeographic analysis, which infers transmission pathways between prefectures by combining viral phylogenies with spatial and temporal sampling information, to SARS-CoV-2 genomic data (n = 62,241). Using inferred inter-prefectural transmission counts as the dependent variable, we estimated a random-effects Poisson gravity model, with origin and destination population sizes and inter-prefectural geographic distance as explanatory variables. To capture temporal dynamics, we included interaction terms between these variables and the four periods: the seeding and epidemic phases of Omicron BA.1 and BA.2.

Results : Larger origin and destination populations were positively associated with inter-prefectural transmission, whereas geographic distance was negatively associated with viral flow. The effects of destination population size and geographic distance strengthened over time.

Conclusion : Our analysis revealed a shift from hierarchical diffusion (spread from urban to rural areas) in the early phase to contagious diffusion (spread following geographic proximity) in the later phase. Understanding this transition is likely to have practical implications for epidemic control. When hierarchical diffusion predominates, interventions should prioritize monitoring and limiting spread from metropolitan areas. Once contagious diffusion prevails, locally focused measures—including inter-prefectural cooperation—become essential.

Asymptotically bias-reduced modified Poisson regression

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Background : Estimating the risk ratio is fundamental in epidemiology and clinical research. The modified Poisson regression is widely used to estimate the risk ratio for binary outcome data; however, it is susceptible to separation issues when data are sparse. Although Jeffreys-type penalized modified Poisson regression has been proposed and empirically shown to yield finite estimates, it is not designed to reduce asymptotic bias.

Objective : This study aims to develop an asymptotically bias-reduced variant of modified Poisson regression.

Methods : Within a general framework for asymptotically bias-reduced M-estimation, we derived a bias-adjustment term for the modified Poisson regression score equations, resulting in an asymptotically bias-reduced estimator. We conducted simulations to compare the performance of three approaches: (i) conventional modified Poisson regression, (ii) Jeffreys-type penalized modified Poisson regression, and (iii) the proposed asymptotically bias-reduced estimator. We simulated scenarios with systematically varied sample sizes and risk ratios. Performance was evaluated based on bias, root-mean-squared error, convergence rate, and coverage probability of 95 % Wald confidence intervals. We also applied the methods to a real dataset with rare events.

Results : In simulation scenarios that induced appreciable bias in the conventional modified Poisson regression estimator, the Jeffreys-type penalized estimator, and the proposed asymptotically bias-reduced estimator demonstrated reduced bias. In the real-data application, the proposed estimator yielded numerically stable risk-ratio estimates that were consistent in magnitude and direction with those from modified Poisson regression.

Conclusions : The proposed asymptotically bias-reduced modified Poisson regression can provide more accurate estimates and reliable inference.

Mobile survey response in Korean adults 50+: randomized outreach protocol comparison

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Background : Following the COVID-19 pandemic, contact-free data collection has become essential. This study evaluated the feasibility and performance of mobile questionnaires among a long-running cohort of adults aged 50 and over by comparing different contact protocols.

Methods : Using 2021 KoGES_HEXA follow-up data, we randomly assigned 6,000 of the 32,943 contactable participants as of 2018 to four groups (n = 1,500). Participants initially received either a postal letter with a QR code or an SMS with a survey link. Non-responders received protocol-specific SMS reminders. The outcomes were mobile response rates, completion rates following initial dispatch, response times, and respondent characteristics.

Results : Overall, 1,241 participants (20.9%) completed the mobile survey. Including those who completed the survey after switching to telephone increased the total response rate to 24.9% (n = 1,476). The total response rate was higher with the postal approach than with the SMS approach (26.5% [n = 793] vs. 23.3% [n = 683]; p = 0.004). However, the completion rate following initial dispatch favoured the SMS approach (9.4% [n = 275] vs. 7.2% [n = 215]; p = 0.002). The response rate was relatively higher among participants under 60 years old (32.8%, n = 655) and among those with a college education (34.0%, n = 679).

Conclusions : Introducing a mobile modality into an established cohort was feasible and revealed protocol-dependent trade-offs: postal letters improved overall uptake, whereas text messages encouraged immediate completion. As today's middle-aged participants grow older cohorts, mobile follow-up is likely to become more useful. Future designs should tailor the initial contact method and reminder timing to participant profiles to maximise participation and contain costs.

Adolescent Substance Use and Mental Health: Multicultural and Non-Multicultural

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Introduction : This study investigates the associations between adolescent substance addiction and mental health outcomes (depression, Generalized Anxiety Disorder(GAD), and suicide), comparing multicultural and non-multicultural groups.

Methods : This study utilized data from the Korea Youth Risk Behavior Survey (KYRBS 2020-2024). To minimize bias between adolescents from multicultural and non-multicultural, 1:1 propensity score matching was performed. Substance addiction was assessed using three factors (smoking, alcohol consumption, and drug use), and a composite score (0–3) was assigned according to the number of substances used. Group differences in substance addiction and mental health were tested using chi-square analysis, and Odd Ratio(OR) with 95% confidence intervals were estimated through logistic regression.

Results : In the non-multicultural group, the risks of depression and GAD increased markedly with higher substance addiction scores. At the score 3, the ORs were 6.37 (95% CI: 5.20–7.79) for depression and 5.59 (95% CI: 4.57–7.09) for GAD.. A similar pattern was observed for suicidal outcomes, with score 3 showing ORs of 16.08 (95% CI: 13.09–17.74) for ideation, 36.24 (95% CI: 29.04–45.23) for planning, and 64.84 (95% CI: 50.90–82.58) for attempts. In the multicultural group, higher substance addiction scores were likewise associated with increased risks, with score 3 corresponding to ORs of 9.88 (95% CI: 3.62–26.99) for depression and 11.24 (95% CI: 3.91–32.34) for GAD. However, suicidal outcomes appeared at lower levels than in the non-multicultural group, with score 3 showing ORs of 12.33 (95% CI: 4.50–33.76) for ideation, 31.59 (95% CI: 10.53–94.84) for planning, and 21.72 (95% CI: 6.57–71.78) for attempts.

Conclusion : These findings underscore the link between adolescent substance addiction and mental health, emphasizing the importance of tailored interventions for each group.