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Abstract

Background. Romanian sociology has lacked systematic personal network analysis (PNA) methods for rural research. Social clustering patterns in health behaviors indicate whether interventions should target individuals or social groups, yet detecting these patterns requires network-level data. We develop and test a PNA design for Romanian rural contexts, using health behaviors to demonstrate the method's capacity to detect social clustering. *Methods.* We conducted tablet-assisted interviews with 83 adult residents in Lerești (Argeș County). Respondents listed social contacts and provided demographic and behavioral data for themselves and their contacts. We tested the protocol across three health topics: vaccination and media use (61 ego networks), smoking (76 egos), and processed food high in salt intake (83 ego networks). Mixed-effects models analyzed clustering patterns with alters nested within egos. *Results.* We detected social clustering in all three topics of interest. Vaccination showed assortative patterns (OR = 3.75, 95% CI 1.79-7.85) and media effects: online-only health information use associated with lower alter vaccination (OR = 0.37, 95% CI 0.15-0.92). Smoking clustered in family-dense networks with demographic variations. Food intake displayed local assortativity beyond composition effects (OR = 1.17, p = 0.01). Network context explained 11-67% of behavioral variance across health topics. *Conclusions.* PNA can be systematically applied in Romanian rural communities to detect social mechanisms across behavioral domains. Our design generates reproducible data suitable for mixed-effects analysis and reveals network effects that individual-level analysis

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would miss. This method contributes to Romanian rural sociology's empirical tradition and provides tools for network-informed public health interventions.

Keywords: personal network analysis; rural sociology; methodology; Romania; health behaviors; social clustering.

Introduction

Dimitrie Gusti's monographic agenda treated health as a central concern of village inquiry (Bucur, 2020). Medical specialists joined field teams and conducted sanitary assessments (Bucur, 2016a). They documented morbidity, hygiene conditions, and access to care (Bucur, 2016a). Nutrition was analyzed as a structural determinant, with recurrent observations on scarcity, seasonality, and deficient diets (Bucur, 2017). This integration consolidated a medical strand within sociology and, as argued by Bucur, anticipated and helped legitimize medical sociology as a field-based subdiscipline (Bucur, 2016b). Our study follows this line. We combine coordinated village research with personal network analysis to trace how health behaviors and risks circulate through everyday ties. The design updates Gusti's medical orientation and targets actionable intervention in contemporary rural contexts.

Despite growing interest in community health and social determinants in Romania and the wider Central and Eastern Europe, replicable rural egocentric-network studies, especially those integrating several health domains in a single site and drawing explicit implications for interventions, remain scarce. This study applies a standardized, reproducible personal network analysis in a Romanian rural community to examine social clustering across vaccination, smoking, and diet, showing that such designs can detect clustering patterns across behavioral domains.

We introduce Lerești (Argeș County) as a contemporary living-lab for rural field research. Our objective is to demonstrate how PNA links social context to health behaviors and to synthesize three studies built on the same ego-alter dataset: (1) vaccination in relation to respondents' health-information repertoires; (2) adult smoking and its clustering within family-dense subnetworks; and (3) processed food high in salt (PFHS) intake and local assortativity.

Seven trained interviewers conducted tablet-assisted, face-to-face PNA interviews with adult residents. Data include ego demographics, alter attributes, kinship and co-residence, tie characteristics, alter-alter acquaintance, and health behaviors. Analyses employ mixed-effects models that account for alters nested within egos. Our procedures met GDPR requirements and received ethics approval.

In this paper, we illustrate the use of personal network analysis in a Romanian rural field setting by providing the necessary framework for data replicability.

In practice, this means a living-lab approach with interviewer-led, tablet-based surveys and analyses that account for people and their social contacts together. We find that vaccination, smoking, and eating processed food high in salt tend to cluster within the social circles. These patterns indicate: the types of media people rely on for health information, how close they are to family, and who their peers are. Therefore, interventions should work through existing social networks: identify trusted community figures to promote vaccination, run smoking-cessation programs focused on households, and provide healthier-eating prompts to small groups of friends or families.

This article consolidates a Romanian rural living-lab into a replicable PNA design and delivers a multi-topic synthesis (vaccination, smoking, diet) from a single field site. To our knowledge, this combination (i.e., standardized network design applied across health topics in Romanian rural contexts) has not been previously reported. We address three research questions, each corresponding to one of the published studies: (1) Vaccination: how do respondents' health-information repertoires (traditional, online, or mixed) relate to alter-level COVID-19 vaccination within their personal networks? (2) Smoking: to what extent does current smoking cluster within family-dense personal networks in a rural adult population? (3) Food intake: do we observe local assortativity in PFHS intake beyond overall network composition and tie intensity?

The rest of the paper is structured as follows. We first review relevant literature on rural field research and personal network analysis. We then describe the methods, i.e., setting, sampling, measures, ethics, and analytic strategy. Next, we present results aligned with our research questions. Finally, we discuss implications, strengths and limitations, and priorities for longitudinal and comparative extensions.

Background

Romanian village studies historically paired team-based, in-situ observation with standardized procedures and a public mission. Contemporary rural sociology builds on that legacy while responding to ageing, chronic disease, migration, and fragmented information ecologies. Methodologically, there is growing emphasis on transparent designs (pre-specified instruments, open code/data) and community benefit (co-designed outputs, feedback to residents). Two persistent challenges are: (a) drawing analytic boundaries in socially fluid villages (seasonal work, circular migration, multilocal families), and (b) identifying relational mechanisms, e.g., how information and norms flow through everyday ties to shape health behaviors.

PNA constructs each respondent's immediate social world (the ego network) and captures both composition (social contacts and their attributes) and structure (how those contacts are tied to one another). In rural settings (where family, neighborhood, work, and church are multiplex), an ego-centered design avoids the boundary problems of whole-network studies while quantifying the micro-contexts

in which decisions are made (Perry, Pescosolido, & Borgatti, 2018; Marsden, 2005; McCarty *et al.*, 2019). Mixed-effects models are appropriate for personal network data where alters are nested within egos, creating hierarchical dependence. These models partition variance into alter-level and ego-level components, which prevents ecological fallacy by distinguishing individual effects from network context. Cross-level interaction terms test whether network composition (such as the proportion of vaccinated alters) moderates individual alter outcomes.

Network research examines selection (homophily), influence (behavioral diffusion), and shared context (common exposures) to explain clustering (Valente, 2010). Key measures for detecting clustering in rural settings include kinship and co-residence (family proximity creates selection effects), contact intensity (frequent interaction enables norm transmission), and alter attributes directly linked to outcomes (e.g., vaccination status, smoking, diet). Assortativity measures detect similarity beyond what baseline composition would predict, providing a quantifiable indicator of local clustering.

Living-lab approaches involve sustained collaboration between researchers and communities to co-produce knowledge and solutions for local challenges (Dell'Era, & Landoni, 2014). Unlike extractive research models, living labs emphasize reciprocal relationships where communities receive tangible benefits while contributing to scientific understanding (Schuurman *et al.*, 2016). In health research, living labs enable iterative intervention development, real-world testing, and community ownership of outcomes (Leminen *et al.*, 2012). The Lerești living-lab implemented this approach through preliminary ethnographic engagement and community immersion, transparent communication of research objectives, and commitment to return results through community health education events and medical consultation services (The living lab is based in Lerești, a rural community in Argeș County, Romania). This reciprocal model addresses privacy concerns inherent in rural network research by building trust and demonstrating research value beyond data extraction. Living-lab frameworks also improve data quality by promoting participant engagement and reducing non-response rates (Dell'Era, & Landoni, 2014).

Deploying PNA in rural fieldwork entails both strengths and limitations. Strengths include ecological validity (data gathered where people live), simultaneous attention to who is in the network and how they are connected, and models that respect the data's nested structure. Limitations include reliance on ego reports, sampling dependence (e.g., link-tracing can favor well-connected residents), and, when designs are cross-sectional, limited options to separate selection from influence. Clear field protocols, consistency checks, longitudinal follow-up, and open materials help mitigate these issues (Perry *et al.*, 2018; McCarty *et al.*, 2019).

Few replicable, field-based PNA studies have: (i) collected ego-alter data in rural communities, (ii) analyzed multiple health topics within the same site,

and (iii) translated results into network-aware interventions. The Lerești living-lab addresses this gap through a transparent PNA research design applied to vaccination (Oană *et al.*, 2024a), smoking (Mihăilă *et al.*, 2024a), and food intake (Hâncean *et al.*, 2025).

Methods

Fieldwork took place in Lerești, a rural commune in Argeș County, Romania, using a living-lab design that coupled community engagement with standardized personal network analysis. Seven trained interviewers administered face-to-face, tablet-based surveys in Romanian to adult residents (aged 18 or older) from September 13 to 30, 2023. Using this approach, we generated an ego-alter dataset analyzed in three published studies on vaccination and media repertoires (Oană *et al.*, 2024a), adult smoking (Mihăilă *et al.*, 2024a), and processed food high in salt intake (Hâncean *et al.*, 2025).

Recruitment combined local outreach with chain-referral sampling starting from initial seeds selected to represent demographic diversity. Eligibility required residence in Lerești, adulthood, and capacity to provide informed consent. Chain-referral sampling is an efficient approach for accessing embedded rural populations (Goodman, 1961). Sample sizes varied by analysis due to different data completeness requirements: the vaccination analysis used 61 complete ego networks with 1,280 alters, the smoking analysis included 76 egos and 1,681 alters, and the PFHS analysis used 83 ego networks with 1,693 alter observations.

Because chain-referral can over-represent highly connected people, we began from six demographically diverse seeds (by age, sex, education, income and occupation) and then used respondent nominations to extend recruitment. We also did community outreach (local meetings and social media) to widen awareness beyond any one branch. Throughout fieldwork, we monitored basic composition (sex, age, and education). We cap the number of nominations per respondent to approximately five (even if some of the respondents recruited more). These steps should improve coverage but do not turn the sample into a probability sample. Accordingly, we avoid prevalence claims and focus inference on within-network clustering.

Interviews followed a standardized PNA framework (Perry *et al.*, 2018; McCarty *et al.*, 2019). Respondents (egos) listed up to 25 socially significant contacts (alters). The name generators first elicited the emotionally closest contacts, followed by those with whom respondents interacted most frequently. For each ego and alter, we recorded sociodemographic characteristics, relationship type (kinship, friendship, acquaintance), co-residence status, and tie intensity (emotional closeness and contact frequency). We documented alter-alter relationships to characterize network density and clustering patterns.

Health behavior measures varied by analysis to address topic-specific research questions. The vaccination analysis measured ego and alter COVID-19 vaccination status and classified ego health-information sources as traditional media only, online media only, or mixed repertoires. The smoking analysis recorded ego smoking status (never, current, former) and calculated the proportion of family members and smokers within each network. The PFHS analysis measured dietary intake frequency for egos and alters. Then, it calculated normalized alter-level assortativity comparing PFHS prevalence among each alter's direct contacts to the baseline prevalence in the remainder of the ego's network (Newman, 2003).

Data management gave priority to confidentiality and legal compliance. All participants provided written informed consent consistent with the Declaration of Helsinki (World Medical Association, 2013/2018). Interview prompts were formulated to minimize the collection of personally identifying details about alters. Data were anonymized, stored under encrypted conditions, and accessed only by authorized researchers. The protocol complied with the General Data Protection Regulation (EU) 2016/679 and received approval from the Center for Innovation in Medicine Ethics Committee, with approval codes and procedures as reported in the three source articles. As part of the living-lab commitment to public value, residents were offered a community health hotline and invitations to local prevention and education events.

Statistical analyses used hierarchical models appropriate for personal network data. For alter-level outcomes, we estimated multilevel logistic regressions with random intercepts at the ego level (Raudenbush, & Bryk, 2002; Gelman, & Hill, 2007). For ego-level outcomes, we used standard or multinomial logistic regression as appropriate.

The vaccination analysis regressed alter vaccination status on ego information repertoire (traditional, online-only, or mixed) and ego vaccination status, controlling for network composition and tie intensity. The smoking analysis modeled ego smoking status (never, current, former) as a function of family-smoker network composition and sociodemographic characteristics. The PFHS analysis examined both alter- and ego-level dietary outcomes using the normalized assortativity measure while controlling for network composition and tie intensity.

We report odds ratios with 95% confidence intervals and two-tailed p-values. Model diagnostics, sensitivity analyses, and software specifications are detailed in the original publications. To support transparency and cumulative research, we adhered to open-science norms for sharing code and de-identified materials where permissible (Munafò *et al.*, 2017). Replication materials including code and de-identified data are openly available.

Missing data were handled through complete-case analysis. The vaccination analysis used 61 ego networks with complete data (1,280 alters), the smoking analysis used 76 egos (1,681 alters), and the PFHS analysis used 83 ego networks

(1,693 alters). Robustness checks comparing complete-case to missingness-indicator specifications are reported in the original publications.

Results

Here, we report the results corresponding to the three analyses, i.e., vaccination and media repertoires (Oană *et al.*, 2024a), adult smoking (Mihăilă *et al.*, 2024a), and processed food high in salt intake (Hâncean *et al.*, 2025), that were estimated on the Lerești living-lab dataset. All models accounted for the nesting of alters within egos (random-intercept multilevel logistic regression). Also, effect sizes are presented as odds ratios (OR) with 95% confidence intervals (CIs), reproducing the specifications and estimates in the published studies.

Vaccination and media repertoires

The vaccination analysis used 61 complete personal networks (each with 15-25 alters), totaling 1,280 alters with valid data. Alters tied to respondents (egos) who relied **only** on online media for health/prevention information had **lower odds of being vaccinated** than alters whose egos relied on traditional media (OR = 0.37, 95% CI 0.15-0.92, $p = .03$). By contrast, reliance on a **mixed** repertoire (traditional + online) did not differ significantly from traditional media alone (OR = 0.75, 95% CI 0.32-1.78, $p = .52$). Alters of **vaccinated** egos were themselves **more likely to be vaccinated** (OR = 3.75, 95% CI 1.79-7.85, $p < .001$), consistent with assortative clustering. In secondary results, alter **education** and being **in a relationship** increased vaccination odds, and the full model outperformed reduced specifications, underscoring the value of incorporating network composition with ego attributes. These findings confirm that online-only repertoires are associated with lower uptake even after accounting for network context. Details on the code and data are openly available for replicability (Oană *et al.*, 2024b).

Adult smoking in personal networks

The smoking analysis included 76 egos with complete smoking and network data. Multilevel models indicated pronounced **local clustering** of current smoking beyond network composition: the alter-level **assortativity (smokers)** term was large and statistically significant in the full specification (OR = 3.01, 95% CI 1.61-5.62, $p = .001$). At the ego level, **women were less likely to be current smokers**, and **older adults were more likely to be former smokers** (female: OR ≈ 0.32-0.33; age: OR ≈ 1.75-1.76 per standardized unit; $p < .001$ in both cases). The analysis also highlighted a positive association between the **number of components** in an ego's network and smoking outcomes (Model 2 OR = 1.17, 95% CI 1.00-1.36; Model 3 OR = 1.24, 95% CI 1.07-1.43; $p < .05$), suggesting

that engagement with multiple social circles can shape smoking behavior. Model diagnostics reported non-trivial clustering at the ego level (ICCs around 0.11-0.18 across specifications), reinforcing the role of network context. Overall, smokers were embedded in **family-dense** subnetworks of smokers, while non-smokers were typically situated in non-smoking environments. Details on the code and data are openly available for replicability (Mihăilă *et al.*, 2024b).

PFHS intake and local assortativity

The PFHS intake analysis drew on **83** ego networks; alters without direct contacts were excluded when computing neighborhood metrics, yielding **1,693** alter-observations clustered in **80** ego networks for the multilevel models. Descriptively, egos' mean age was **54.3** years (SD 15.7), **53%** were female, **77%** reported an income below the national net average, **87%** were not single, and **46%** reported frequent PFHS intake (daily/weekly). Networks averaged **23.7** alters (SD 3.1) with relatively high density (mean **0.70**, SD 0.20). Among alters, **43%** consumed PFHS frequently, **36%** were reported with obesity, **13%** were on a diet, and the mean local assortativity term was slightly positive (mean **0.002**, SD 0.11).

In alter-level multilevel models, **local assortativity** in PFHS intake was positive and statistically significant after controlling for alter, ego, and network covariates (Model 2 OR = **1.17**, $p = .01$), indicating that frequent consumption clusters in small peer groups beyond overall network composition and tie intensity. Between-ego variation was substantial (ICC = **0.66-0.67**), underscoring the role of ego-level context. Several covariates behaved as expected: alters who reported following a **diet** had **lower odds** of frequent PFHS intake (OR = **0.23**, $p < .01$), **older** alters were less likely to consume PFHS frequently (OR ≈ **0.57-0.58**, $p < .01$), and higher **BMI** among alters was associated with higher PFHS intake (OR ≈ **1.44-1.45**, $p < .01$). Ego-level characteristics such as ego sex and ego PFHS intake also entered the models; the full specification reported strong overall explanatory power (total pseudo-R^2 ≈ **0.72**). These results document robust **local clustering** of PFHS intake in everyday networks. Details on the code and data are openly available for replicability (Hâncean, 2024).

Cross-study synthesis

Across the three topics, health-related behaviors **cluster within everyday personal networks** in Lerești. Exclusive **online-only** repertoires are associated with lower vaccination among alters, and vaccination itself shows strong assortativity; **smoking** concentrates locally (especially within family-dense subnetworks) with clear **age** and **gender** gradients in cessation; and **dietary** risk (PFHS intake) exhibits **local assortativity** net of composition, with restraint cues (self-reported dieting) linked to markedly **lower** intake. Together, these results indicate that **media repertoires, family proximity, and peer composition** shape outcomes

in this rural Romanian setting, and they motivate **network-aware** interventions tailored to clusters rather than only to individuals.

Discussion and concluding remarks

This living-lab study shows that health-related behaviors in a Romanian village are networked phenomena: they concentrate in everyday social circles and are shaped by who people interact with and how they get information. Working from one ego-alter dataset, we reproduced three published analyses and obtained a coherent picture across topics. In the vaccination study, alters connected to respondents (egos) who relied exclusively on online media for health information had lower odds of being vaccinated, whereas alters of vaccinated egos were much more likely to be vaccinated, i.e., clear evidence of assortative clustering. In the smoking study, current smoking was embedded in family-dense subnetworks. Particularly, women were less likely to smoke and older adults were more likely to be former smokers. In the food intake study, frequent PFHS intake displayed local assortativity even after controlling for composition and tie intensity, pointing to small peer groups as carriers of dietary practice. Together, these results situate vaccination, smoking, and diet within the same relational logic. Specifically, micro-contexts of routine interaction are the proximal environments in which information, norms, and habits are reinforced.

The vaccination pattern connects two strands of prior work. First, research on information environments and vaccine hesitancy stresses that channel mixes and selective exposure matter for uptake (MacDonald, 2015; Vraga *et al.*, 2023). Second, network studies show that preventive behaviors exhibit homophily and diffuse through social ties (Valente, 2010; Smith, & Christakis, 2008; Christakis & Fowler, 2007). Our estimates for Lerești add that an online-only repertoire is associated with lower odds of vaccination net of network composition, whereas a mixed repertoire is not. This nuance suggests that traditional channels may buffer against online echo-segmentation by maintaining exposure to locally credible messengers, that is actors who anchor trust in communities where digital health literacy varies.

For smoking, our results reproduce classic gender and age gradients and underscore the household/kin nexus as the primary locus of persistence and cessation. Network-health reviews have long emphasized that behavior change often follows re-embedding in different subnetworks (Smith, & Christakis, 2008; Valente, 2010). The Lerești evidence of strong local clustering (beyond baseline composition) is consistent with this view and with the idea that dense family ties amplify both enabling and constraining influences on tobacco use.

Dietary practices are similarly social. Experimental and observational work shows that eating norms and choices respond to peers and context (Higgs, &

Thomas, 2016). The Lerești models operationalize this with a normalized, alter-level assortativity metric and show non-trivial clustering of PFHS intake within small groups even after accounting for who is in the network and how strongly they are tied. The high intraclass correlation reported in those models indicates that a large share of variance lies between ego networks, reinforcing that interventions should target clusters, not just individuals. This is compatible with broader evidence linking social relations to health risk and mortality (Holt-Lunstad, Smith, & Layton, 2010).

We set out to demonstrate how personal network analysis connects social context to health behaviors in a Romanian rural setting and to fuse results from three studies built on the same dataset. The first objective is addressed by showing that a single PNA architecture (ego/alter attributes, tie context, and alter-alter acquaintance) explains outcomes across three distinct topics. The second objective is addressed by integrating the original estimates (Oană *et al.*, 2024a; Mihăilă *et al.*, 2024a; Hâncean *et al.*, 2025) into a cross-topic narrative centered on clustering within proximal ties. Methodologically, the living-lab contributes a transparent, reproducible workflow for rural PNA (interviewer-administered, tablet-assisted surveys; ego-alter modules; multilevel modelling accounting for nesting). Substantively, it yields a multi-topic mixture from a single field site, enhancing internal comparability and practical interpretability.

Across the three behaviors, the data are consistent with three classic mechanisms that generate similarity in networks (Valente, 2010). People often form and maintain ties with similar others (e.g., smokers spend more time with smokers; skeptical actors cluster with skeptical actors online and offline), i.e., *social selection*. Behaviors and norms shift through repeated contact, especially in strong-tie contexts such as households, close kin, or long-standing neighbor groups, i.e., *social influence* (Smith, & Christakis, 2008; Centola, 2010). People embedded in the same micro-environments face the same constraints and cues, e.g., shops, churches, workplaces, which can produce parallel outcomes even without direct influence, i.e., *shared context* (Higgs, & Thomas, 2016). Our results cannot fully disentangle these processes, i.e., social selection, influence and shared context (two of the analyses are cross-sectional). Yet, the local assortativity patterns in smoking and PFHS intake, together with assortative vaccination and the media-repertoire contrast, are precisely the expected outcomes when these mechanisms operate together.

Our findings are consistent with the classic triad (selection, influence, and shared context) and point to distinct interpretations and tests. Assortative vaccination and family-dense smoking suggest selection (homophily), where similarity arises because people preferentially keep ties with similar others. The PFHS clustering we observe within close, multiplex ties makes influence plausible, as repeated exposure to norms and practices within households and neighbor groups can reinforce behavior. Shared context can also generate parallel behavior via availability and cues, independent of persuasion. Because our analyses are

cross-sectional, we refrain from causal claims. However, the design motivates longitudinal tests that separate mechanisms: stability of network composition (selection), lagged alter-ego effects within the same ties (influence), and context fixed effects or place-based changes (shared context). These implications inform targeting (e.g., households vs. peer clusters vs. place-based points) and the design of next-step evaluations.

Several actionable implications follow for rural public health. For vaccination, campaigns should work through existing ties: identify credible local messengers (e.g., family doctors, nurses, teachers, priests, respected elders) who bridge clusters, and equip them with materials that complement mixed information repertoires rather than relying on online-only pushes (Oană *et al.*, 2024a; Vraga *et al.*, 2023). Micro-targeting by cluster (e.g., street, parish group, workplace team) can usefully complement mass campaigns. For smoking, we recommend household- and kin-based cessation supports, e.g., joint transgenerational interventions, counselling for couples, family contracts, and small-group follow-ups (Mihăilă *et al.*, 2024a). This uses the same family density that currently sustains smoking. For diet, use small-group nudges (defaults, placement, swap offers) delivered where people buy and share food (shops, markets, church events). Because PFHS intake clusters locally, shifting a few key-alters in a group (e.g., the person who buys or cooks for others) may have outsized effects (Hâncean *et al.*, 2025; Higgs, & Thomas, 2016).

Our study comes with several strengths and limitations. Strengths include the shared field site and PNA protocol, which allow *a like-for-like* comparison across topics; ecological validity from face-to-face fieldwork; and multilevel models that align with the data structure and avoid ecological fallacy. Open replication packages in the three studies further enhance transparency and reusability (Oană *et al.*, 2024a; Mihăilă *et al.*, 2024a; Hâncean *et al.*, 2025). Limitations should also be accounted. Two analyses (smoking, PFHS intake) are cross-sectional, limiting the separating of selection from influence (Valente, 2010). Ego reports of alter attributes introduce potential recall and projection biases; the studies mitigate this via standardized prompts and tie-intensity controls but cannot remove it entirely. Chain-referral improves feasibility but can inflate the probability of selection for high-degree egos. Our controls (diverse seeds, cap, monitoring) reduce but do not remove this concern. Finally, the results are site-specific; Lerești's social ecology (age structure, migration, media access) may differ from other communes, which cautions against naive generalization.

The clustering patterns observed in Lerești likely vary with settlement structure and migration intensity. In semi-urban areas with more diverse activity spaces and weaker kin co-residence, we expect lower density and greater bridging. This, in turn, could dilute family-based smoking clusters while amplifying peer-based diffusion for food intake and vaccination. In migrant-heavy settings, transnational ties and multilingual media repertoires may reshape information channels, potentially strengthening the link between online-only repertoires and vaccination gaps or, alternatively, buffering those gaps when trusted diaspora channels act as credible

messengers. Using the same PNA protocol, replication across sites differing in kin density, workplace mix, and digital penetration, would allow identification of contextual moderators of clustering and intervention effectiveness.

Three extensions would strengthen inference and application. First, the implementation of a longitudinal panel in Lerești and neighboring communes to follow tie change and behavior change; repeated measures would enable formal tests separating selection from influence and allow modelling of tie-decay and habit formation (Valente, 2010). Second, conduct cluster-randomized trials of network-aware interventions: (i) credentialled messenger programs for vaccination targeted to clusters with online-only repertoires; (ii) household cessation packages; and (iii) small-group PFHS nudges, with egocentric metrics both as targeting tools and outcomes (Higgs, & Thomas, 2016; Oană *et al.*, 2024a; Mihăilă *et al.*, 2024a; Hâncean *et al.*, 2025). Third, pursue comparative replications across rural sites that vary in migration intensity, healthcare access, and digital penetration to identify contextual moderators of clustering and intervention effectiveness (Smith, & Christakis, 2008).

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