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Original Article

When Periodontal Trial Findings Can Inform Care across Health Systems: An Original Transportability Framework Integrating Baseline Disease Burden, Maintenance Capacity, and Access to Tooth-Preserving Treatment

Ingrid Larsen[1]*, Henrik Sørensen[2], Astrid Haugen[3], Even Dahl[4], Silje Moen[5], Kristian Aas[6]

[1]Department of Periodontology, Norwegian University of Science and Technology, Trondheim, Norway.
[2]Department of Oral Health, University of Oslo, Oslo, Norway.
[3]Department of Periodontology, University of Bergen, Bergen, Norway.
[4]Department of Dental Public Health, University of Tromsø, Tromsø, Norway.
[5]Department of Periodontology, University of Oslo, Oslo, Norway.
[6]Department of Oral Diagnostics, Norwegian University of Science and Technology, Trondheim, Norway.

***E-mail** ✉ ingrid.larsen@ntnu.no

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ABSTRACT

Randomized periodontal trials can establish internally valid effects under specified clinical and organizational conditions, yet those effects may not translate directly to populations treated within different disease, maintenance, financing, and service-delivery environments. Conventional discussions of external validity often underrepresent the dependence of long-term periodontal outcomes on continued supportive care and access to tooth-preserving treatment. This non-empirical methodological analysis integrates contemporary transportability methods with evidence on periodontal disease heterogeneity, social patterning, treatment pathways, supportive periodontal care, and health-system access. It separates statistical transport of trial estimates from the broader clinical question of whether the intervention package, maintenance environment, outcome definition, and treatment alternatives observed in a trial remain achievable in a target system. Transportability in periodontology cannot be judged from demographic similarity alone. Three linked dimensions require explicit evaluation: the baseline periodontal state and progression profile of the target population; the capacity to deliver and sustain the maintenance conditions on which long-term outcomes depend; and access to timely tooth-preserving treatment before disease progression closes therapeutic options. Differences in these dimensions can alter absolute benefit, realized treatment exposure, outcome interpretation, and the relevance of trial comparators even when trial efficacy estimates are internally credible. Periodontal trial transportability is best treated as a conditional inference about an intervention embedded within a care pathway rather than as a property of the trial alone. Explicit source–target characterization is required before evidence generated in one health system is interpreted as directly applicable to another.

Keywords: Periodontitis, Transportability, External validity, Supportive periodontal care, Health systems, Tooth preservation

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Introduction

Randomized clinical trials are designed principally to establish internally valid comparisons within defined study populations and treatment environments. Whether their findings answer the same causal or clinical question in another population is a separate problem. Transportability therefore concerns the conditions under which an effect identified in a source

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population can inform a distinct target population, whereas generalizability more commonly addresses extension from a study sample to the population from which that sample was drawn [1]. This distinction matters in periodontal research because the clinical effect observed during a trial is embedded within eligibility criteria, diagnostic distributions, operator expertise, maintenance schedules, recall systems, treatment availability, and outcome definitions that may differ substantially from routine care.

Formal approaches to trial transportability can adjust for measured differences between source and target populations through weighting, outcome modeling, or doubly robust strategies [2]. These approaches have made the external-validity problem more explicit, replacing vague claims of representativeness with estimable target-population questions. Contemporary clinical applications show that trial findings can be re-expressed for populations whose covariate distributions differ from those enrolled in the original experiment [3]. Yet such adjustment is credible only when the variables necessary to explain relevant treatment-effect heterogeneity have been measured and when the target population itself is adequately characterized.

Applied transportability research remains heterogeneous in its estimands, data sources, analytic choices, and reporting practices [4]. For periodontology, this creates an additional difficulty. Variables that determine whether trial care is reproducible may include not only patient characteristics but also disease stage, prior tooth loss, treatment complexity, the availability of supportive periodontal care, affordability of repeated visits, specialist access, and whether potentially maintainable teeth are retained long enough to receive definitive therapy. A statistical model can rebalance observed patient covariates; it cannot manufacture a maintenance system, specialist workforce, or treatment pathway that does not exist in the target setting.

The central methodological question is therefore not whether a periodontal trial is broadly "applicable," but what exactly must remain sufficiently comparable for its result to support a decision elsewhere. This article treats transportability as an inference linking a trial population to a target population within a target health system. It distinguishes three forms of mismatch: differences in underlying periodontal disease burden and progression, differences in the capacity to reproduce the treatment and maintenance environment, and differences in access to tooth-preserving care before irreversible disease or extraction changes the available treatment set. These distinctions provide the basis for evaluating when an internally valid periodontal trial remains clinically informative across health systems and when its interpretation requires qualification.

Conceptual foundations of trial transportability

Transporting a trial effect requires a defined target estimand and assumptions connecting trial participation, measured covariates, treatment, and outcome. G-formula and inverse-probability approaches provide alternative representations of this task, but their validity depends on correct specification of the variables required to account for relevant source–target differences [5]. In practice, the methodological issue is not simply whether a target dataset is available. Investigators must determine whether that dataset contains variables that meaningfully capture the characteristics on which treatment response or treatment delivery differs.

The way the target population is sampled is also consequential. When population information comes from a complex survey, failing to account for the survey design can change the population being implicitly targeted and therefore the interpretation of the transported estimate [6]. A periodontal study seeking relevance to a national patient population may consequently require different target information from a study intended to inform patients attending specialist clinics or individuals covered by a specific dental-benefit scheme. "Target population" is not a descriptive label; it is part of the causal and clinical question.

Inverse-probability-of-sampling approaches clarify another important boundary. Weighting can make measured source-population characteristics resemble those of a target population under appropriate assumptions [7]. It cannot correct differences in unmeasured modifiers, replace absent treatment infrastructure, or guarantee that the intervention actually delivered outside the trial corresponds to the intervention evaluated within it. For periodontal research, a transported estimate can therefore remain statistically well constructed while still being clinically incomplete if the intervention presupposes maintenance frequency, surgical expertise, restorative coordination, or patient follow-up that the target system cannot reproduce.

Periodontal disease classification provides one clinically meaningful layer for defining source–target differences. Contemporary staging and grading distinguish severity, treatment complexity, extent of tissue destruction, and anticipated progression rather than treating periodontitis as a homogeneous diagnosis

[8]. These characteristics should not automatically be called treatment-effect modifiers, because classification alone does not establish interaction with treatment. They are nevertheless essential descriptors when deciding whether a target population resembles the population in which a treatment strategy was tested. A trial dominated by lower-complexity disease may not resolve the same clinical question for a target system in which advanced attachment loss, compromised dentition, or complex rehabilitation is common.

The therapeutic environment is similarly structured. Evidence-based management of stage I–III periodontitis is organized as a stepwise pathway in which behavioral risk control, subgingival instrumentation, reevaluation, additional treatment when required, and supportive periodontal care are interdependent components [9]. Stage IV disease adds functional and rehabilitative problems that may require multidisciplinary management beyond control of periodontal inflammation alone [10]. A trial intervention should consequently be interpreted together with the surrounding care pathway that made the observed result possible. Transporting the active procedure while disregarding the diagnostic, maintenance, rehabilitative, and follow-up conditions surrounding it risks transporting only a fragment of the tested intervention.

These considerations establish several distinct questions that should remain separate during external interpretation. Investigators must specify whose treatment effect is being transported, whether clinically important differences between source and target populations are observed, whether the relevant intervention can be delivered with comparable fidelity, and whether the outcome measured in the trial represents the outcome that matters in the target system. **Table 1** organizes these transportability domains without treating any single domain as a sufficient test of applicability.

Table 1. Clinical transportability domains that must be resolved before a periodontal trial estimate is interpreted for another health system

Analytical unit	Source-trial question	Target-system question	Consequence of unresolved mismatch	Interpretation permitted
Target population	Which population does the trial effect actually describe?	Which patients and care settings must the decision represent?	A numerically transported estimate may target the wrong clinical population	Define the target before estimating applicability
Trial participation	Which measured characteristics influenced enrollment or trial participation?	Are those characteristics distributed differently in the target population?	Selection adjustment may be incomplete	Adjust only for measured and defensible source–target differences
Periodontal state	What stages, grades, disease extent, tooth conditions, and progression profiles were represented?	Are severity and complexity comparable in the target population?	Absolute prognosis and feasible treatment options may differ	Treat disease state as a transport descriptor unless effect modification is demonstrated
Treatment pathway	What diagnostic, operative, behavioral, and rehabilitative components accompanied the tested intervention?	Can the target system reproduce those components?	The delivered intervention may no longer correspond to the trial intervention	Transport the care pathway only to the extent that its defining components are reproducible
Maintenance environment	What recall, supportive periodontal care, monitoring, and retreatment conditions followed active therapy?	Can comparable longitudinal maintenance be sustained?	Long-term outcomes may reflect different post-treatment exposure	Separate active-treatment efficacy from maintenance-dependent durability
Outcome and horizon	Which surrogate, clinical, tooth-survival, functional, or patient-reported outcome was measured, and when?	Does the same endpoint answer the target decision?	An apparently transportable effect may concern the wrong outcome or time horizon	Interpret only the endpoint and horizon directly supported

Residual uncertainty	Which potential modifiers were unmeasured or weakly represented?	Are those factors likely to differ materially in the target system?	Statistical precision may conceal structural uncertainty	Classify applicability as uncertain when essential source–target information is absent

Periodontal disease burden and population differences

Transportability becomes clinically consequential when source and target populations differ in the amount, distribution, or trajectory of disease present before treatment. Global estimates demonstrate pronounced geographic heterogeneity in oral conditions, including periodontal disease [11]. Such variation does not by itself prove that a relative treatment effect will change. It does, however, alter the clinical population to which an effect is applied, the likely absolute number of patients who may benefit, the distribution of treatment complexity, and the resources required to deliver care.

Severe periodontitis remains a major global burden, with substantial regional variation and projections indicating continued pressure on health systems as populations grow and age [12]. A trial performed in a setting with earlier diagnosis and lower baseline complexity may therefore be transported into a system where patients commonly present later, after greater attachment loss or tooth-level compromise. Even if the biological efficacy of an intervention were stable, the proportion of patients still eligible for that intervention and the absolute consequences of delaying care could differ substantially.

Population differences also extend beyond clinical classification. Periodontal disease is socially patterned, with socioeconomic position, education, material resources, behavioral exposures, and access to care contributing to unequal distributions of disease [13]. These characteristics can influence baseline periodontal status while also influencing whether patients can enter and remain in longitudinal treatment. They therefore occupy an ambiguous but important position in transportability analysis: some are markers of underlying risk, some affect care exposure, and some may influence both.

US population data illustrate the clustering of adverse social determinants among adults with periodontitis [14]. Such evidence should not be interpreted as proof that a particular social exposure modifies a periodontal treatment effect. Its methodological significance is that source and target populations can differ across several correlated dimensions that are poorly represented by a small set of demographic covariates. A transported estimate that balances age and sex but ignores large differences in socioeconomic adversity, insurance, smoking distribution, prior dental attendance, or accumulated disease may still describe an incompletely matched population.

Disease trajectory is heterogeneous even within age-defined groups. Longitudinal evidence from younger individuals with periodontitis shows that progression cannot be inferred from age alone and that clinically relevant baseline characteristics remain important [15]. This limits the usefulness of broad population labels such as “younger adults” when source–target comparison requires information on disease extent, progression history, risk exposure, and treatment need. Target-population description should consequently preserve clinically meaningful heterogeneity rather than seeking representativeness through demographic averaging.

Contextual exposures can further alter the population encountered by the health system. Longitudinal evidence links neighborhood deprivation to deterioration in oral health and tooth loss among older adults [16]. Financial burden is similarly important: evidence on out-of-pocket oral-health expenditure shows substantial heterogeneity in both the measurement and occurrence of financial hardship across settings [17]. Economic assessments of periodontitis prevention and management likewise emphasize that value depends on how services are organized, financed, and sustained [18]. These findings connect population burden to the later health-system analysis because the patients who reach periodontal care are partly selected by the conditions under which care is available.

For transportability analysis, these observations support a distinction between baseline disease composition and treatment-delivery capacity. The first asks whether the target population presents with a different distribution of severity, progression risk, tooth maintainability, or competing clinical needs. The second asks whether the target system can deliver the intervention and its necessary follow-up. **Table 2** retains this distinction while identifying patient- and population-level characteristics that can change the meaning of a trial result without assuming that every characteristic modifies the biological treatment effect.

Table 2. Patient and population differences that can change the interpretation of transported periodontal trial findings

Population feature	Source–target comparison required	Pathway through which interpretation may change	What can be inferred	What must not be inferred automatically
Baseline disease burden	Distribution of disease prevalence and treatment need	Alters absolute number of eligible patients and expected event burden	Absolute clinical relevance may differ	Relative treatment efficacy necessarily differs
Stage and treatment complexity	Severity, tooth-level compromise, rehabilitation requirements	Changes feasible treatment set and resource intensity	Trial eligibility may map poorly to target patients	Stage is a proven treatment-effect modifier
Progression profile	History or indicators of faster versus slower deterioration	Changes untreated prognosis and urgency of intervention	Target prognosis may differ from trial population	A single progression factor determines outcome
Age and life-course context	Age structure together with disease history and competing needs	Alters cumulative disease exposure and feasibility of long follow-up	Age can define clinically different target contexts	Chronological age alone explains transport failure
Social determinants	Material, educational, behavioral and socioeconomic conditions	Shape disease distribution, care seeking, adherence, and treatment opportunity	Social composition belongs in source–target characterization	Observational association establishes biological causality
Neighborhood conditions	Deprivation, physical access, local service environment	Influences opportunity for diagnosis, attendance and continuity	Area context may contribute to realized care exposure	A deprivation measure has the same meaning across countries
Financial exposure	Out-of-pocket cost, coverage and household financial burden	Influences entry into treatment and persistence with maintenance	Affordability can constrain implementation	One universal affordability threshold exists
Tooth-preservation opportunity	Timing of diagnosis relative to tooth maintainability	Changes whether a trial-tested tooth-preserving option is still available	Late presentation can narrow the relevant treatment set	Extraction or replacement is intrinsically superior when preservation becomes difficult

Health-system conditions affecting treatment effects

A periodontal trial can be clinically informative only if the treatment contrast tested in the source setting corresponds sufficiently to treatment that can be delivered in the target system. This requirement extends beyond the availability of a procedure. Universal health coverage discussions increasingly recognize that excluding oral health from financial protection leaves major components of essential care inaccessible even when effective interventions exist [19]. For periodontal transportability, coverage therefore influences whether the target population can receive the active treatment, the necessary sequence of reevaluation and retreatment, and the long-term maintenance on which durability may depend.

Population oral health is also shaped by organizational and structural conditions that operate upstream of the clinical encounter [20]. The distinction is important because poor transportability can arise in at least two ways. A biological treatment effect may genuinely differ across populations, or the same potentially effective treatment may produce different realized outcomes because the target system delivers a substantially different exposure. The latter should not be mislabeled as biological effect modification. It represents a mismatch between the intervention package evaluated in the trial and the care pathway implemented in practice.

Geographic access illustrates this problem. Spatial analyses of dental services show that travel burden and service reach can vary across regions and according to

provider participation in publicly supported coverage [21]. Repeated periodontal treatment amplifies the importance of this difference because care rarely consists of a single encounter. An intervention tested where patients can return for instrumentation, reevaluation, surgery when indicated, and scheduled maintenance is not operationally identical when each stage requires difficult travel or when specialist services are concentrated far from the target population.

Variation can remain substantial even within a nominally common financing and regulatory system. Register-based evidence from Denmark demonstrates marked practice-level variation in the provision of subsidized dental services [22]. Such findings do not establish that high or low service use is clinically correct. They do show that formal availability of a service cannot be equated with uniform implementation. For transportability analysis, workforce behavior, practice organization, referral patterns, and continuity therefore belong alongside patient characteristics when comparing the source trial environment with the target system.

Financial and geographic constraints may also operate jointly. Among older Australian adults, remoteness-related inequality in dental-service use was partly associated with measured financial and social differences and partly remained unexplained by those factors [23]. The exact decomposition is setting-specific and should not be transported as a universal estimate. Its broader relevance is methodological: a target health system can modify whether patients are exposed to treatment through mechanisms not represented in clinical trial eligibility data. Where access determines who receives treatment and who continues maintenance, source–target adjustment using clinical variables alone can be insufficient.

These system characteristics can be assessed without constructing an unsupported numerical "applicability score." **Table 3** instead separates the dimensions that determine whether a periodontal intervention can be reproduced as a longitudinal care pathway.

Table 3. Health-system conditions that determine whether a periodontal trial intervention can be reproduced in practice

Health-system condition	Transportability question	Potential disruption of the trial treatment pathway	Evidence needed for target-system assessment	Appropriate interpretation when information is insufficient
Coverage architecture	Are active periodontal treatment and necessary follow-up financially covered or otherwise affordable?	Patients may receive only fragments of the intervention sequence	Benefit design, patient charges, eligibility and exclusions	Applicability remains uncertain rather than assumed
Geographic reach	Can patients physically reach generalist and specialist services at the frequency required?	Delayed diagnosis, incomplete active therapy or missed maintenance	Travel time, regional service distribution and referral access	Distinguish geographic feasibility from biological efficacy
Provider and practice capacity	Are required procedures, monitoring and referrals routinely deliverable?	Trial-standard treatment may be simplified, delayed or unavailable	Workforce, service provision and referral patterns	Treat implementation mismatch as a separate source of uncertainty
Longitudinal continuity	Can patients remain linked to care after active treatment?	Initial treatment is delivered without the maintenance environment supporting durability	Recall infrastructure, retention, continuity and retreatment pathways	Do not extrapolate long-term trial outcomes from active therapy alone
Financial persistence	Can patients sustain repeated visits over years rather than finance only initial treatment?	Maintenance exposure becomes intermittent or terminates	Longitudinal patient cost and financial-protection information	Avoid defining adherence without considering affordability
Treatment alternatives	Are tooth-preserving procedures available before extraction becomes the default pathway?	The target comparator differs from the comparator studied in the trial	Availability of periodontal, endodontic, restorative and rehabilitative options	Reconstruct the actual target decision rather than importing the trial comparator unchanged

Communication and cultural fit	Can consent, self-care instruction, risk communication and repeated follow-up be delivered effectively?	The practical content of longitudinal care may differ even if procedures are available	Language support, communication resources and culturally responsive service capacity	Treat communicative capacity as contextual unless a treatment interaction is directly demonstrated

Health-system capacity also includes whether care can be delivered in a form patients can meaningfully use. Evidence from providers serving culturally and linguistically diverse populations identifies language, communication, organizational, and cultural barriers alongside potential facilitators of oral-health delivery [24]. These findings should not be converted into numerical treatment-effect modifiers. They instead show that nominal access and realized access are different constructs. A periodontal service may exist, yet the sequence of informed decision-making, behavioral support, attendance, and longitudinal maintenance may still differ from the environment in which a trial was conducted.

The preceding sections therefore establish a source–target boundary with several non-equivalent components. Population disease burden influences who requires treatment and at what level of complexity. Trial design determines which patients and outcomes generated the effect estimate. Health-system capacity determines whether the treatment and its longitudinal support can be reproduced. These components interact, but they should not be collapsed into a single undifferentiated judgment of external validity. **Figure 1** represents that boundary as a multilevel landscape in which an internally credible trial effect crosses into a target health system only through explicitly assessed population, treatment-pathway, and implementation conditions.

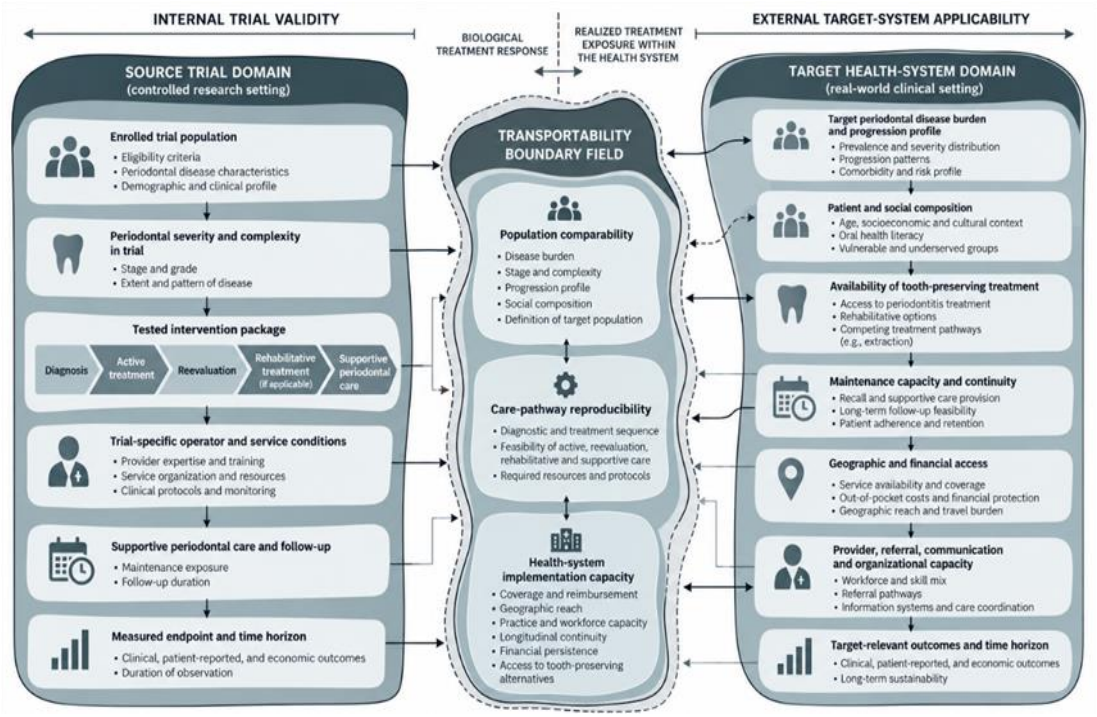


Figure 1. Transportability boundary between periodontal trial populations and target health systems

An original framework for evaluating transportability

A transportability judgment in periodontal care should begin by asking whether the treatment evaluated in the source trial remains clinically available to the target patient under the conditions in which that patient will actually receive care. Long-term prospective evidence indicates that tooth loss during supportive periodontal care can remain limited in successfully treated populations, although losses are concentrated among patients with less favorable risk profiles [25]. Maintenance capacity is therefore not merely a background characteristic. It is part of the exposure through which the durability of active periodontal treatment is realized.

Long-term molar evidence reinforces this point. Periodontally treated molars can remain functional for many years when embedded in maintenance programs, although survival estimates vary across patients, teeth,

and studies [26]. A trial demonstrating successful tooth preservation in a highly maintained population should consequently not be interpreted as direct evidence that the same result will occur where supportive care is unavailable, intermittent, or financially inaccessible.

Disease burden and maintenance also interact. Long-term evidence suggests that periodontal stage and grade modify the amount of retreatment required and the cumulative costs incurred during supportive care [27]. These findings do not justify universal economic thresholds, because costs depend on the health system in which they are measured. They do demonstrate that baseline disease complexity can change the intensity of the longitudinal care pathway that must be reproduced if a trial result is to remain clinically meaningful elsewhere.

Discontinuity provides a complementary warning. Patients who discontinue supportive periodontal therapy can experience less favorable periodontal stability and greater tooth loss than those remaining in maintenance [28]. Because discontinuation is not randomly assigned, such observations cannot identify a pure causal effect of maintenance attendance. Nevertheless, they show why trial transportability cannot be reduced to whether active treatment is technically available. The target system must also be capable of sustaining the post-treatment conditions on which durable benefit may depend.

Outcome choice adds another boundary. Clinical treatment endpoints achieved after active periodontal therapy do not necessarily distinguish long-term tooth-loss trajectories with sufficient precision [29]. A transported estimate can therefore be misleading even when source and target populations appear similar if the endpoint itself is poorly aligned with the target decision. Transportability requires agreement not only about patients and treatments but also about what constitutes clinically meaningful success and the period over which that success is evaluated.

Randomized evidence further indicates that supportive-care protocols can produce different periodontal outcomes and that factors such as smoking and residual deep pockets can influence the observed response [30]. Such findings support a conditional interpretation: health-system capacity may affect realized outcomes by changing the maintenance exposure actually delivered, while patient-level characteristics can alter the response within that maintenance environment. Neither mechanism should be converted into a universal numerical transportability score.

The resulting assessment should therefore preserve separate judgments rather than collapsing evidence into a single rating. **Table 4** operationalizes the framework as an auditable set of source–target comparisons.

Table 4. Assessment structure for judging the applicability of periodontal trial evidence across health systems

Assessment component	Evidence to establish in the source trial	Information required from the target setting	Interpretation when concordant	Interpretation when discordant or unknown
Baseline periodontal state	Disease stage, complexity, progression profile and relevant tooth conditions	Distribution of corresponding clinical states	Population applicability becomes more defensible	Effect interpretation requires qualification
Treatment availability	Procedures, expertise and associated treatment components actually delivered	Availability of the same clinically defining components	Tested treatment can potentially be reproduced	Trial intervention and target intervention may not be equivalent
Tooth-preserving opportunity	Eligibility and timing at which preservation was attempted	Whether patients reach care while comparable options remain feasible	Trial comparator may remain relevant	Target clinical decision may differ fundamentally
Maintenance capacity	Supportive-care schedule, monitoring, retreatment and continuity	Feasibility of sustaining comparable long-term care	Durability evidence becomes more transferable	Long-term benefit cannot be assumed from active treatment alone
Access environment	Financial, geographic and organizational conditions surrounding trial care	Coverage, travel burden, provider availability and continuity	Realized exposure may resemble trial care	Implementation failure may dominate observed effectiveness
Outcome alignment	Clinical endpoint, patient-reported outcome and follow-up horizon	Outcome needed for the target decision	Trial result answers a similar decision problem	Transport of the numerical effect may answer the wrong question

Evidence sufficiency	Measured effect modifiers and source–target covariates	Corresponding target data of adequate quality	Formal transport analysis may be justified	Applicability should remain explicitly indeterminate rather than scored

A final methodological safeguard concerns validation across populations. Periodontal prediction models that perform strongly in their development population can show appreciable loss of discrimination when tested externally [31]. Although prediction transport is not equivalent to transporting a causal treatment effect, the example is instructive: apparent performance within a source dataset is insufficient evidence of performance elsewhere. The same principle applies to the framework proposed here. A favorable transportability assessment is a reasoned inference contingent on available information, not a certification that treatment effects are invariant.

These relationships produce a nonlinear applicability structure in which disease burden, maintenance capacity, access, endpoint alignment, and evidentiary sufficiency constrain one another. **Figure 2** represents that conditional structure without turning the framework into an automated treatment rule.

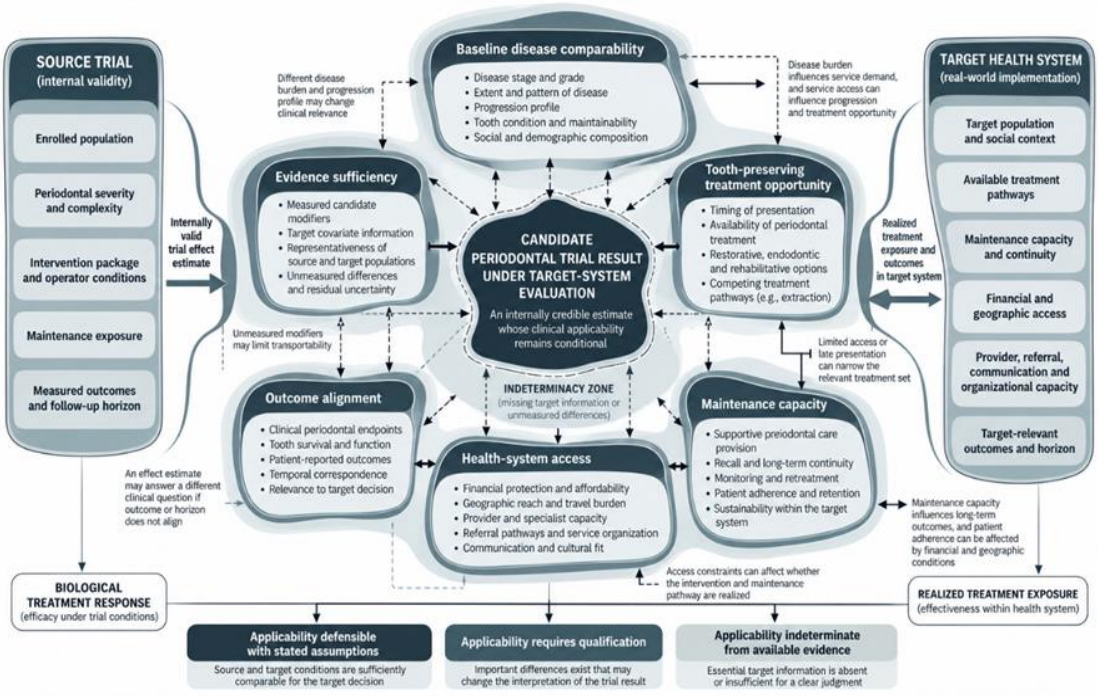


Figure 2. Conditional evidence-applicability landscape for periodontal treatment across health systems

Applications to global periodontal research and methodological limitations

The framework can first be applied during trial design. Investigators seeking future cross-system relevance should prospectively identify clinically plausible effect modifiers and record information describing disease complexity, treatment exposure, maintenance, and target-relevant outcomes. Biological measurements can contribute to this characterization, but their role requires restraint. Longitudinal periodontal evidence shows that salivary and serum inflammatory biomarkers can behave differently during progression and treatment [32]. Such measurements may help explain heterogeneity, yet they should not be promoted to transportability determinants until their modifying role is independently established.

Outcome selection requires similar discipline. Long-term follow-up indicates that achievement of selected periodontal treatment endpoints does not necessarily translate into clear differences in oral-health-related quality of life [33]. A trial can therefore be internally valid for a surrogate or clinical endpoint while remaining only partially informative for a target decision focused on tooth retention, function, patient experience, or long-term treatment burden. Transportability analyses should state this outcome boundary explicitly instead of assuming that successful movement of an effect estimate also transports its clinical meaning.

Long-term evidence also challenges an intervention-centered conception of external validity. A systematic review of periodontal interventions followed under

strict supportive care found that differences associated with initial treatment can diminish over extended maintenance [34]. This does not establish equivalence among periodontal interventions. It demonstrates that the maintenance environment can become a major determinant of the durable outcome being interpreted. A trial conducted in a system capable of intensive long-term supportive care may therefore answer a different practical question from the same trial implemented where maintenance is fragmented or inaccessible.

Important methodological limitations remain. Statistical transportability depends on sufficient measurement of variables responsible for relevant source–target differences [1]. Weighting or outcome modeling cannot recover the effects of unmeasured system characteristics simply because those characteristics are clinically plausible [5]. Likewise, population weights do not substitute for information on whether a complex periodontal pathway can be implemented [6]. The appropriate conclusion in such circumstances is not that the trial "does not apply," but that transportability cannot be established with the available evidence.

The framework should therefore be used as an explicit reporting and reasoning structure rather than as a predictive algorithm. Future periodontal trials intended to inform diverse health systems should report treatment-pathway components, maintenance exposure, disease complexity, loss to longitudinal care, target-relevant outcomes, and contextual variables that would permit subsequent source–target comparison. Where target-system data are available, formal transport methods can complement this clinical assessment. Where they are absent, uncertainty should remain visible rather than being replaced by unsupported claims of universal applicability.

Conclusion

Periodontal trial findings can inform care across health systems only when the inference extends beyond internal trial validity to the conditions under which treatment is delivered, maintained, and interpreted. Differences in baseline disease burden, access to tooth-preserving care, supportive periodontal capacity, and outcome relevance can change the clinical meaning of an otherwise credible treatment estimate. Transportability should therefore be evaluated as a conditional source–target judgment rather than assumed from trial quality or demographic similarity. When essential target information is unavailable, the scientifically appropriate conclusion is indeterminate applicability, not automatic acceptance or rejection of the evidence.

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