

The Behavioral Ecology of Prevention: How Culture, Social Networks, Risk Perception, and Institutional Trust Shape Health Actions

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Abstract

Preventive health actions are often explained as consequences of individual knowledge, motivation, risk perception, or willingness. Such explanations are incomplete when the same person may act differently across diseases, social settings, institutional environments, and moments of changing uncertainty. This article develops a behavioral ecology account of prevention in which health action emerges from the interaction of perceived threat, collective meaning, social-network exposure, institutional trust, practical opportunity, and expectations about other people's behavior. The framework distinguishes psychological appraisal from observed behavior, interpersonal influence from institutional conditions, and willingness from the capacity to act. Culture is treated not as a fixed group attribute but as a context shaping norms, legitimacy, and social consequences. Social networks are represented as channels through which information, expectations, and behavior can diffuse without assuming that observed similarity proves contagion. Trust is disaggregated by institutional object and linked to both credibility judgments and prior institutional experience. Material costs, accessibility, and service organization define unequal opportunity structures within which intentions become more or less actionable. The article proposes that prevention is best understood as context-dependent coordination under unequal constraints. This model generates bounded predictions for intervention design and public communication while requiring empirical validation across populations, behaviors, institutions, and time.

Keywords: Preventive health behavior, Risk perception, Social norms, Social networks, Institutional trust, Health equity

Introduction

Preventive health behavior is commonly framed as a problem of whether individuals know enough, perceive sufficient risk, trust recommendations, or intend to act. These constructs are relevant, but they are not interchangeable. Vaccine hesitancy, for example, has been defined and operationalized inconsistently across the literature, with attitudes, indecision, intentions, delay, and observed uptake sometimes treated as manifestations

of the same underlying state [1]. A behavioral explanation becomes weaker when a psychological construct is inferred from an outcome that may also depend on access, social pressure, service availability, or changing circumstances.

Social and behavioral evidence from the COVID-19 period further shows that prevention cannot be reduced to an isolated calculation of personal risk. Threat perception operates alongside social norms, identity, leadership, communication, cooperation, and institutional conditions [2]. Experimental evidence indicates that congruent normative signals and leadership can strengthen preventive intentions and adherence, whereas conflicting social signals may undermine them [3]. Meta-analytic evidence also associates social identification with health-related attitudes, intentions, and behavior, although effect patterns differ by identity

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and behavior [4]. At the population level, vaccine confidence has changed substantially across countries and time [5]. These findings make a stable “pro-prevention” or “anti-prevention” disposition an insufficient general theory.

This article therefore proposes a behavioral ecology of prevention. The term ecology does not imply that every determinant has equal causal weight or that contextual associations establish mechanisms. Rather, it denotes an analytical system in which psychological appraisal occurs inside relational, cultural, informational, institutional, and material environments. The central claim is that preventive action becomes more intelligible when three distinctions are preserved: willingness versus opportunity, exposure to a recommendation versus its social interpretation, and individual preference versus interdependent behavior. The model developed later integrates these distinctions while treating the resulting architecture as a proposed theory rather than an empirically validated causal system.

Prevention as context-dependent behavior

Preventive action is context-dependent because a nominally identical recommendation can correspond to very different feasible choices. For marginalized populations, vaccination encounters can be shaped by prior experience with the state, perceived autonomy, outreach practices, and whether services are experienced as responsive or coercive [6]. These conditions are not simply additional attitudes. They partly define the environment within which an attitude can become action. Psychological models remain important within this ecology. Integrated social-cognitive evidence indicates that broader dispositions and beliefs can be translated into behavior through more proximal constructs such as perceived norms, control, intentions, and behavioral evaluations [7]. Trust can similarly influence action through proximal social-cognitive pathways rather than functioning as a single direct behavioral cause [8]. This matters theoretically because two people expressing similar trust or risk perceptions may still differ in intention formation, perceived control, or the practical possibility of acting.

Opportunity is particularly visible when institutional implementation is examined directly. An audit study of vaccination-information practices found that accessibility and the information supplied to people could vary across institutional encounters, including by language [9]. In such cases, failure to obtain or act on

preventive information cannot safely be interpreted as low motivation. Population studies of COVID-19 vaccination intention likewise show substantial social patterning [10], but observed group differences do not reveal which mechanism generated them.

The distinction can be stated as a simple conceptual rule: behavioral readiness is not behavioral feasibility. Readiness concerns whether action is psychologically acceptable or intended; feasibility concerns whether the action is realistically available at acceptable material, social, temporal, and institutional cost. The proposed framework treats observed prevention as the conditional intersection of the two. This prevents structural constraints from being relabeled as deficient motivation while also avoiding the opposite error of assuming that context makes individual appraisal irrelevant.

Risk perception and threat appraisal

Risk perception is often positioned at the beginning of prevention models: people perceive danger, judge themselves susceptible, and act. Empirical evidence instead suggests that appraisal is temporally and socially interpreted. Research in southeast Alaska showed that COVID-19 risk perceptions and protective responses changed over time within a locally specific social environment [11]. Comparative longitudinal evidence similarly links vaccine acceptance with changing risk perception and confidence rather than supporting a context-free, fixed threat-to-action relationship [12].

The object being evaluated also matters. Conjoint evidence demonstrates that willingness to accept vaccination responds to characteristics attributed to the preventive option itself [13]. Thus, a person can regard a disease as serious yet judge a particular preventive action as ineffective, inconvenient, unsafe, socially costly, or institutionally suspect. High perceived threat therefore need not generate high uptake.

Institutional appraisal can become part of this translation process. Evidence examining support for health policy suggests that institutional trust participates in the relationship between protection-motivated judgments and public support [14]. The present article consequently treats threat appraisal as an interpreted input rather than a behavioral command. Perceived severity and susceptibility may increase motivation, but their consequences depend on beliefs about the response, the source recommending it, the social meaning of compliance, and whether action is feasible.

This distinction also guards against reverse inference. Observing nonparticipation does not establish low perceived risk, just as high uptake does not prove fear. Prevention can arise from habit, occupational requirements, solidarity, convenience, identity, or institutional routines, while non-action can coexist with considerable concern. Measurement should therefore separate perceived threat, response evaluation, intention, opportunity, and observed behavior whenever the explanatory question requires those distinctions.

Culture, norms, and collective meaning

Culture enters preventive behavior not as a demographic essence but as a field of shared expectations, institutional histories, identity-relevant meanings, and sanctions. Cross-national research on cultural tightness and looseness indicates that societies differ in the strength and enforcement of norms and that these differences were associated with pandemic outcomes [15]. Such ecological evidence cannot establish how any particular individual interprets a norm, but it demonstrates why prevention models that assume equivalent social meaning across settings are incomplete.

Multicountry evidence provides a more proximal view. Relationships between vaccination intentions and normative signals vary across cultural contexts, while individual perceived norms and collective normative climates can remain analytically distinct [16, 17]. This distinction matters because “others approve of this action,” “others perform this action,” and “people like me are expected to perform this action” are different social

messages. Their influence can also depend on whether the relevant reference group is family, peers, religious community, political group, clinicians, or the wider public.

Normative influence is not inherently health-promoting. Social norms can sustain avoidance, concealment, stigma, opposition to official recommendations, or free-riding as readily as they can facilitate preventive coordination [18]. Moreover, evidence from an underserved urban population in India indicates that vaccination intentions were related to norms, interpersonal communication, and confidence in ways that resist a single additive explanation [19]. Normative meaning is therefore better treated as conditional on the network through which it is communicated and on the material and institutional environment in which compliance occurs.

The proposed synthesis is that culture affects prevention by shaping what an action means socially, whereas norms provide more immediate expectations concerning what relevant others do or approve. Identity determines which audiences are psychologically consequential; institutions influence which norms acquire authority; and resource constraints determine whether complying with a norm is feasible. These dimensions should remain separated even when they interact.

The distinctions are easier to compare as mechanism–context cases than as a single continuum of “cultural influence”; therefore, **Table 1** separates the principal pathways, modifiers, and interpretive boundaries.

Table 1. When collective meaning changes the behavioral significance of a prevention recommendation

Social process likely to matter	Context that changes its force	Equity-sensitive failure mode	Interpretive boundary	Consequence for prevention theory
Collective-meaning configuration — A behavior is widely observed				
Descriptive expectation makes the action appear normal or feasible	Visibility of behavior, credibility of observations, relevance of the reference group	Marginalized groups may observe a different local norm from the population average	Observed prevalence does not establish approval or motivation	Treat descriptive norms as local social information, not population-wide commands
Collective-meaning configuration — A behavior is socially approved				
Injunctive expectation creates anticipated approval or disapproval	Strength of social ties, sanctioning capacity, identity relevance	Compliance may carry unequal social costs across communities	Approval does not guarantee enactment when opportunity is constrained	Separate normative legitimacy from behavioral feasibility
Collective-meaning configuration — Prevention becomes identity-relevant				
Group identification changes which	Salience of the identity and compatibility among overlapping identities	Demographic classification may be mistaken for	Group membership alone cannot reveal subjective identity	Model reference-group relevance rather than

messages and messengers matter		psychological identification		assigning fixed cultural traits
Collective-meaning configuration — Norm enforcement is comparatively strong				
Deviations may become more socially consequential	Institutional enforcement, perceived legitimacy, collective threat	Strong norms can reproduce exclusion as well as coordination	Country-level cultural indicators cannot diagnose individual motives	Treat cultural tightness as a contextual modifier, not an individual score
Collective-meaning configuration — Prevention is discussed within close relationships				
Conversation interprets official information and signals expectations	Network composition, trust, interpersonal credibility	Unequal access to trusted information can amplify locally concentrated beliefs	Discussion may transmit correction, uncertainty, or misinformation	Connect norms to the relational channels through which they become meaningful
Collective-meaning configuration — Counter-norms make nonparticipation legitimate				
Opposition or free-riding becomes socially defensible	Political meaning, prior institutional conflict, perceived behavior of others	Stigma or sanction can fall disproportionately on less powerful groups	Strong norms are not necessarily health-promoting	Include adverse and oppositional normative equilibria as genuine boundary cases

Note: The final column expresses the article's proposed analytical synthesis. The table does not rank cultures, populations, or normative configurations.

Social networks and behavioral diffusion

Social networks provide the relational infrastructure through which prevention-relevant information and expectations circulate. Ego-network research shows that network composition, interpersonal discussion, and perceived norms can be associated with preventive knowledge and behavior, while longitudinal research on social-media use suggests that informational and normative pathways may operate differently across political audiences [20, 21]. These findings caution against treating "social influence" as a single exposure. Network processes can also extend intervention effects beyond direct recipients. Evidence from a workplace randomized intervention linked healthier food choices among enrolled workers with spillover patterns among some socially connected nonparticipants [22]. The implication is not that every preventive behavior is contagious. Rather, behavior observed in a tie can modify what seems normal, attainable, desirable, or expected. Systematic synthesis of health-related choice further distinguishes different sources and functions of social influence, particularly informational and prescriptive pathways [23].

Digital environments complicate this architecture because the apparent source of a message, the person

sharing it, the platform context, and the corrective response can each carry social information. Experimental work on vaccine-misinformation correction illustrates that correction itself can be embedded in social influence [24]. A factual message delivered by a peer, institution, platform label, or anonymous source therefore need not have equivalent behavioral meaning.

The present framework proposes three network functions that should not be collapsed. Exposure determines what information and behavior become visible. Interpretation determines how contacts and reference groups assign credibility or social meaning. Feedback occurs when one person's action alters the environment subsequently observed by others. Network homophily, shared environments, and common institutional exposure can generate behavioral similarity without interpersonal transmission, so diffusion should not be inferred merely from correlation.

Figure 1 compresses these distinctions by keeping interpersonal, group, mediated, and institutional channels separate while showing the reciprocal routes through which they can converge on prevention-relevant interpretation.

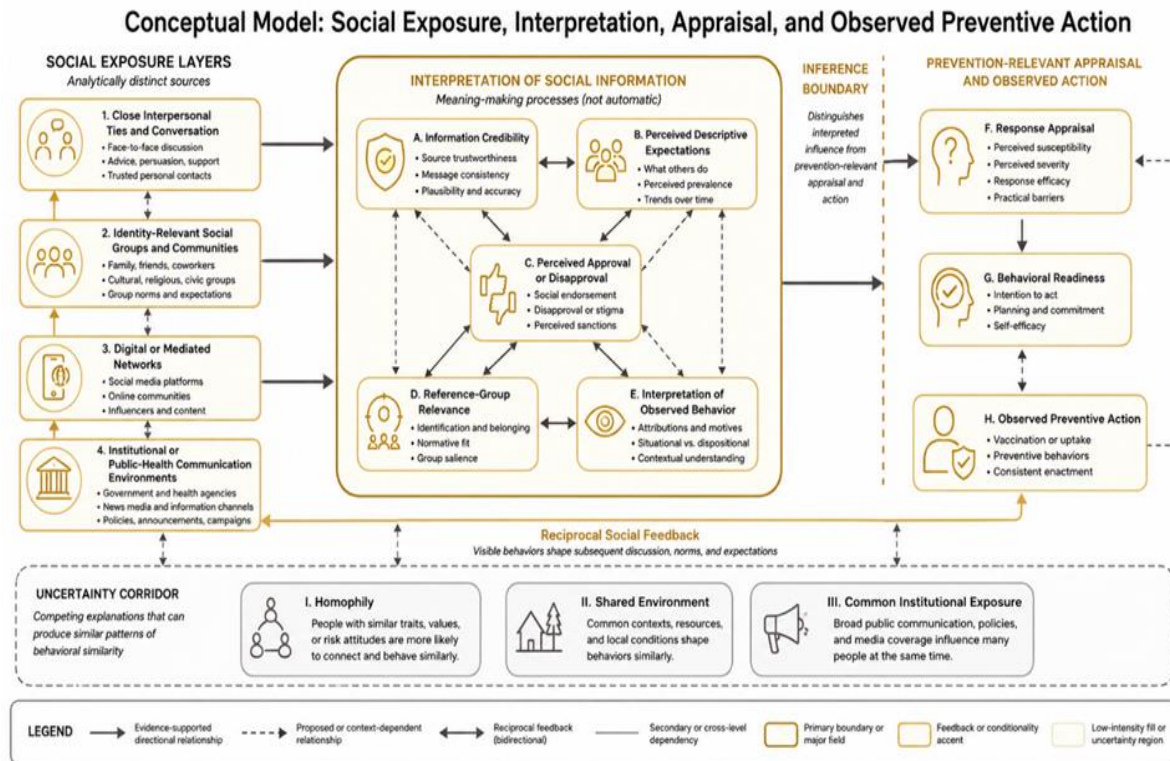


Figure 1. Network position determines which preventive signals become visible, credible, and socially consequential

Trust in health and public institutions

Trust is frequently invoked as though it were a stable personal characteristic. For prevention theory, the more useful question is trust in whom, for what, and under which institutional conditions. Evidence from South Africa found associations between government trust, reliance on social media for news, and vaccination willingness, with patterns differing across vaccines and respondent characteristics [25]. U.S. evidence likewise positions vaccine trust within a wider social ecology that includes institutional confidence and perceived norms [26].

Trust should therefore be disaggregated by object. Confidence in clinicians, public-health agencies, government, scientific institutions, media, and local community leaders may not coincide. Nor does lower trust imply indifference to health. Longitudinal evidence indicates that favorable behavioral beliefs can remain predictive of preventive behavior even when trust in public-health sources is relatively low [27]. This is important because distrust may redirect information seeking rather than terminate prevention motivation.

Political and institutional meaning also matters. Qualitative synthesis of populist-aligned accounts of public-health interventions illustrates how recommendations can be interpreted through questions of authority, legitimacy, elite power, and autonomy [28]. Such interpretations cannot be corrected simply by adding technical information if the contested issue is who has the right to define risk or demand cooperation.

The information environment forms an additional boundary. Recent conceptual work argues that misinformation, trust, and the wider information environment should be analytically separated rather than treating all informational disadvantage as an individual deficit [29]. This distinction is useful because credibility depends not only on what a person believes but on what information is repeatedly available, through which channels, and from which institutions.

In the proposed behavioral ecology, trust functions as a relational permission structure: it changes the degree to which institutional claims are allowed to inform appraisal and action. It does not guarantee compliance, and low trust does not guarantee refusal. **Table 2** therefore registers the boundary conditions under which the same

broad label—trust—can describe meaningfully different prevention environments.

Table 2. Boundary conditions that prevent institutional trust from being treated as a single behavioral variable

Trust object	Institutional signal	Prior context	Behavioral relevance	Alternative account	Prevention effect
Trust relationship — Trust in government					
What is actually being judged	Competence, motives, legitimacy, fairness, or authority	Conditions under which trust may facilitate prevention	Recommendations align with credible implementation and prior experience	When the same trust indicator becomes misleading	General political approval may not imply confidence in a specific health intervention
Power or access boundary	State encounters may differ across marginalized groups	Interpretation in the behavioral ecology	Specify the institution and evaluative dimension rather than using undifferentiated “trust”		
Trust relationship — Trust in public-health authorities					
What is actually being judged	Expertise and reliability of health guidance	Conditions under which trust may facilitate prevention	Guidance is consistent, intelligible, responsive, and actionable	When the same trust indicator becomes misleading	Favorable behavioral beliefs may support action even when institutional trust is low
Power or access boundary	Ability to access guidance and services can differ from willingness to accept it	Interpretation in the behavioral ecology	Treat trust as one input into appraisal rather than a necessary prerequisite for action		
Trust relationship — Trust in clinicians or local health actors					
What is actually being judged	Professional competence and interpersonal credibility	Conditions under which trust may facilitate prevention	Trusted relationships translate recommendations into personally relevant advice	When the same trust indicator becomes misleading	Trust in a clinician does not imply trust in government or media
Power or access boundary	Continuity and access to trusted professionals are unequally distributed	Interpretation in the behavioral ecology	Keep interpersonal and institutional trust analytically separate		
Trust relationship — Trust in mediated information					
What is actually being judged	Credibility of news, platforms, communicators, and repeated claims	Conditions under which trust may facilitate prevention	Source and message cues align with prior credibility judgments	When the same trust indicator becomes misleading	Heavy reliance on a channel cannot itself reveal belief in any particular message
Power or access boundary	Information environments and exposure opportunities differ structurally	Interpretation in the behavioral ecology	Model the information environment independently from individual belief		
Trust relationship — Distrust rooted in institutional experience					
What is actually being judged	Fairness, recognition, autonomy, and historical treatment	Conditions under which trust may facilitate prevention	Repair may occur when institutions demonstrate responsiveness and meaningful choice	When the same trust indicator becomes misleading	Labeling distrust as ignorance hides its relational origins

Power or access boundary	Marginalization, coercion, exclusion, and language access can shape institutional experience	Interpretation in the behavioral ecology	Distinguish epistemic uncertainty from legitimacy-based distrust
Trust relationship — Politically interpreted distrust			
What is actually being judged	Whether health authority is perceived as aligned with unacceptable power	Conditions under which trust may facilitate prevention	Trusted alternative messengers may preserve engagement
Power or access boundary	Political power and representation shape whose authority is accepted	Interpretation in the behavioral ecology	Diagnose the contested relationship before selecting a communication strategy

Note: "Relational permission structure" is the article's proposed theoretical interpretation; it should not be read as an empirically validated latent variable.

Costs, convenience, and opportunity structures

Prevention requires more than favorable beliefs. Time, transport, appointment systems, language, service geography, paid leave, caregiving responsibilities, digital access, administrative burden, and the availability of trusted providers can change whether preventive behavior is feasible. A global systematic review of underserved populations found that vaccine uptake is shaped by interacting health beliefs, norms, information, trust, and contextual facilitators rather than by a single attitudinal deficit [30].

Opportunity structures matter conceptually because they alter the meaning of observed non-action. A missed vaccination appointment can arise from low confidence, but it can also arise because the clinic is distant, opening hours conflict with work, booking requires digital access, or information is not linguistically accessible. Conversely, highly convenient provision can increase uptake without changing underlying beliefs. Intention, utilization, and attitude therefore remain distinct outcomes.

The proposed behavioral ecology represents these conditions as pathway width. The metaphor is deliberately nonquantitative. A wide pathway means that several feasible routes connect readiness with action; a narrow pathway means that practical, institutional, or social constraints make action difficult even when motivation exists. Pathway width can vary between people exposed to the same recommendation and can change over time as services, employment conditions, caregiving demands, or institutional practices change.

This framing has an equity advantage. It prevents the unequal distribution of opportunity from becoming

invisible inside individual-level categories such as "nonadherent," "hesitant," or "hard to reach." It also avoids assuming that structural disadvantage eliminates agency. People continue to appraise risk and make choices, but the set of realistically available choices is unequally organized.

Conditional cooperation and social feedback

Many preventive actions are interdependent. Vaccination, masking during infectious outbreaks, testing, isolation, and other behaviors can create benefits or costs that extend beyond the actor. In such settings, people may ask not only "Will this protect me?" but also "Will others participate?", "Will my contribution matter?", and "Are the expectations applied fairly?" Experimental work on herd-immunity communication shows that explaining collective benefits can strengthen prosocial vaccination motives while also revealing the possibility of free-riding [31].

Cooperation is therefore conditional in two senses. First, willingness may depend on beliefs about other people's participation. Second, participation itself changes the social environment from which later beliefs are formed. High visible participation can strengthen descriptive norms and expectations of reciprocity; visible nonparticipation can normalize disengagement. Leadership and injunctive norms can reinforce this cycle when their messages are aligned, whereas conflicting signals can weaken coordination. Counter-norms can similarly make refusal socially legitimate even when official recommendations remain unchanged.

The proposed model treats this as a feedback process rather than a static determinant. Preventive action

produces social information. That information is interpreted through networks, identities, and trust, then becomes part of the context for subsequent action. The resulting equilibrium need not be socially desirable: cooperation, free-riding, polarization, and locally stable

nonparticipation are all plausible states depending on incentives and perceived legitimacy.

Table 3 separates these social-feedback configurations because the same visible level of participation can arise through very different mechanisms and therefore imply different intervention strategies.

Table 3. How cooperation changes when prevention becomes socially interdependent

Feedback process	Likely consequence for cooperation	Context sensitivity	Critical failure mode	Status in the model
Social configuration — Norms and legitimate leadership point toward the same action				
Approval and observed participation mutually reinforce expectations	Coordination can become easier as participation becomes socially predictable	Depends on leader legitimacy and reference-group relevance	Apparent consensus may conceal groups excluded from the dominant norm	Evidence-supported premise; integration into the ecology is proposed
Social configuration — Participation becomes increasingly visible				
Behavior supplies new descriptive information to others	Cooperation may become self-reinforcing	Visibility must be credible and locally relevant	Public averages may misrepresent what people observe in their own networks	Proposed reciprocal feedback built from supported normative mechanisms
Social configuration — Collective benefit is made salient				
Action is interpreted partly as contribution to others	Prosocial motivation may increase	Depends on perceived effectiveness and fairness	Individuals may reason that others' participation makes their own contribution unnecessary	Evidence-supported collective-benefit/free-riding boundary
Social configuration — Others appear not to cooperate				
Expected reciprocity falls	Personal willingness may weaken even if private attitudes remain favorable	Stronger where contribution is perceived as individually costly	Nonparticipation can become normalized through repeated observation	Proposed feedback state requiring prospective testing
Social configuration — Official norms conflict with network norms				
Competing authorities supply different expectations	Coordination becomes unstable or segmented	Identity and network composition determine which norm is influential	Strong official messaging can intensify opposition in some groups	Evidence-supported conflict premise; model-level consequences proposed
Social configuration — Institutional trust is low but preventive beliefs remain favorable				
Behavioral evaluation partly substitutes for source credibility	Cooperation can persist without generalized institutional trust	Depends on feasibility and confidence in the action itself	Interventions that focus only on "restoring trust" may misdiagnose the binding constraint	Evidence-supported boundary incorporated into proposed ecology

Note: The table distinguishes evidence-supported premises from model-level feedback configurations that require direct longitudinal and network-based validation.

Heterogeneity across prevention contexts

A behavioral ecology theory must treat heterogeneity as information rather than statistical inconvenience. Differences in preventive action across populations can arise from variation in exposure, perceived threat, social meaning, trust, opportunity, or the interaction among

these conditions. U.S. evidence on racial, ethnic, and nativity differences in COVID-19 vaccination hesitancy illustrates why demographic categories should not themselves be interpreted as mechanisms: disparities changed when measured social and contextual factors were considered [32]. Group membership may locate

people within unequal histories and opportunity structures, but it cannot reveal an individual's motives, trust, identity, or perceived risk.

The same principle applies across countries, diseases, institutions, and time. A strong normative signal may promote action where the relevant group approves prevention yet become ineffective where another identity is more salient. Institutional distrust may impede acceptance in one setting but coexist with favorable behavioral beliefs in another. High perceived risk may motivate action when services are accessible while producing frustration or avoidance when action is costly. Digital exposure can reinforce local networks in one population and compete with them in another.

Heterogeneity therefore defines boundary variation in the proposed model. A relationship observed in one ecology should not automatically be transferred to another because the active constraint may change. Testing the theory requires identifying which pathway changes, rather than merely documenting that effect sizes differ between demographic groups. Particularly important boundaries include prevention type, disease severity, stage of an outbreak, institutional history, political meaning, social-network composition, accessibility, and whether outcomes measure attitudes, intentions, service use, or observed behavior.

A behavioral ecology model of prevention

The evidence assembled across the preceding sections supports several distinct propositions without establishing one unified causal mechanism. Risk appraisal is dynamic; social meanings and norms vary across settings; network exposure can alter informational and normative environments; institutional trust affects how recommendations are interpreted; and opportunity structures constrain whether favorable intentions can become action. Conditional cooperation adds feedback because one person's visible behavior can alter the environment experienced by others.

This article integrates those premises into a proposed Behavioral Ecology Model of Prevention. The model contains five analytically separable domains: interpreted threat, collective meaning, relational exposure, institutional credibility, and action opportunity. None is positioned as the master cause. Preventive action is

proposed to become more likely when these domains align sufficiently to make an action simultaneously understandable, socially tolerable, credible, and feasible. Misalignment can generate non-action through different pathways even when the observed behavioral outcome is identical.

The first domain, interpreted threat, concerns perceived susceptibility and severity together with judgments about the preventive response. The second, collective meaning, includes norms, identity-relevant expectations, legitimacy, and the anticipated social consequences of action. The third, relational exposure, represents what information and behavior become visible through interpersonal and mediated networks. The fourth, institutional credibility, concerns whether recommendations and implementing institutions are considered competent, legitimate, responsive, and trustworthy. The fifth, action opportunity, concerns whether the behavior is realistically achievable given time, cost, accessibility, service organization, language, and other constraints.

These domains interact rather than simply accumulate. Network exposure can modify perceived norms; institutional experience can change credibility; credibility can alter interpretation of risk information; visible uptake can feed back into social expectations; and opportunity constraints can weaken the behavioral consequence of strong motivation. The model therefore rejects a single additive "barrier burden." Two people with the same number of unfavorable conditions may face fundamentally different mechanisms requiring different responses.

A central feature is the distinction between constraint and opposition. Non-action caused by inaccessible services is analytically different from deliberate rejection of a recommendation, just as uncertainty differs from active distrust. Likewise, high uptake may reflect enthusiasm, habit, mandate, convenience, social conformity, or limited alternatives. Behavioral classification alone cannot identify the pathway that produced it.

Table 4 makes these exceptions explicit because intervention design depends more on the mechanism producing apparent nonparticipation than on the behavioral label itself.

Table 4. Failure states that expose where a prevention model would misdiagnose the binding constraint

Prevention failure	Binding constraint	Model failure	Context modifier	Corrective target	Validation test
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Observed prevention state — High concern, low action					
Hidden ecological configuration	Threat is salient but opportunity is narrow	Why a simple motivation account fails	Concern cannot overcome inaccessible or costly implementation	Competing interpretation that must be tested	Response may be feasible but judged unacceptable or ineffective
Boundary most likely to change the case	Service access, time, language, employment, caregiving	Model implication	Diagnose feasibility separately from willingness		
Observed prevention state — Low institutional trust, continued action					
Hidden ecological configuration	Credibility of authorities is weak but behavioral beliefs remain favorable	Why a simple motivation account fails	Trust is not a necessary condition for every preventive action	Competing interpretation that must be tested	Habit, mandate, peer expectation, or personal benefit may explain action
Boundary most likely to change the case	Prevention type and source of recommendation	Model implication	Do not make generalized trust the sole intervention target		
Observed prevention state — Strong favorable norms, low uptake					
Hidden ecological configuration	Social approval exists but pathways to action remain constrained	Why a simple motivation account fails	Normative support does not create appointments, transport, or autonomy	Competing interpretation that must be tested	The perceived norm may not belong to the actor's relevant reference group
Boundary most likely to change the case	Network composition and resource access	Model implication	Test reference-group relevance and opportunity independently		
Observed prevention state — High uptake, weak personal endorsement					
Hidden ecological configuration	Action occurs despite ambivalence	Why a simple motivation account fails	Behavior cannot be read backward as strong confidence	Competing interpretation that must be tested	Convenience, requirement, conformity, or routine may account for participation
Boundary most likely to change the case	Institutional setting and degree of choice	Model implication	Separate observed behavior from psychological endorsement		
Observed prevention state — High information exposure, persistent refusal					
Hidden ecological configuration	Exposure is abundant but credibility or legitimacy is low	Why a simple motivation account fails	More information does not resolve a disputed source relationship	Competing interpretation that must be tested	Response concerns, identity conflict, or counter-norms may dominate
Boundary most likely to change the case	Messenger, institution, political meaning	Model implication	Diagnose interpretation before increasing message volume		
Observed prevention state — Locally stable nonparticipation					
Hidden ecological configuration	Network feedback normalizes low participation	Why a simple motivation account fails	Individual intention models omit reciprocal social updating	Competing interpretation that must be tested	Shared structural constraints may mimic interpersonal diffusion
Boundary most likely to change the case	Network homophily and common environment	Model implication	Distinguish social transmission from shared context		
Observed prevention state — Successful correction, uncertain downstream behavior					
Hidden ecological configuration	Belief accuracy improves without demonstrated action change	Why a simple motivation account fails	Intermediate informational outcomes	Competing interpretation	Generalized skepticism or low exposure may offset correction

Boundary most likely to change the case	Platform, population, behavioral endpoint	Model implication	do not establish behavioral benefit	that must be tested
			Require outcome-specific validation before claiming intervention success	

Note: The ecological configurations and model implications are proposed analytical classifications. They are not diagnostic scores, validated patient categories, or quantitative risk strata.

The overall theory is more legible as a constraint–opportunity landscape than as a linear sequence. **Figure 2** therefore shows how equivalent psychological

readiness can encounter unequal pathways to action while social, institutional, and network processes recursively reshape the landscape.

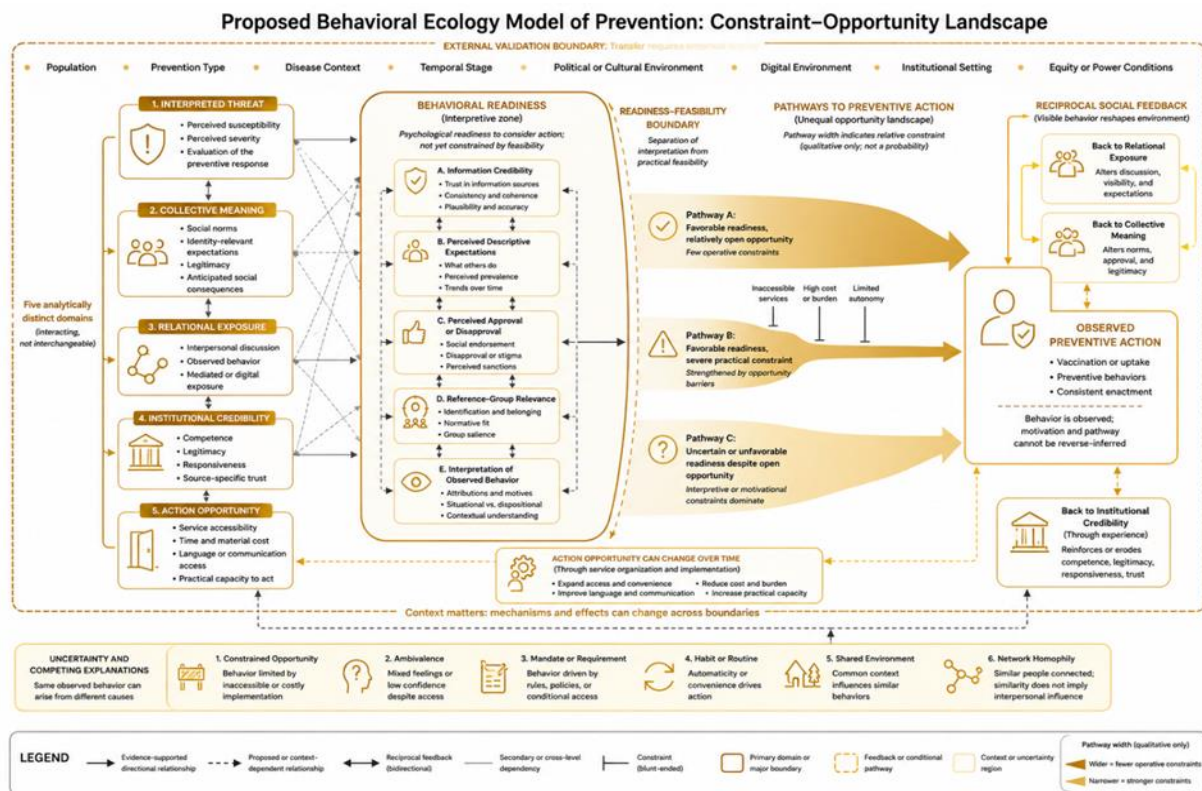


Figure 2. Unequal opportunity pathways determine whether preventive readiness can become action

Predictions for intervention and public communication

The framework generates predictions by asking which ecological condition is binding. If practical opportunity is narrow, additional persuasive messaging should have limited behavioral effect unless feasibility changes. If the principal constraint is institutional legitimacy, increasing technical detail without changing messenger or institutional conduct may also have little effect. If inaccurate descriptive norms dominate, communication that makes credible local participation visible may matter more than generic risk amplification. These are

predictions of the proposed model, not established intervention rules.

Evidence on transferability reinforces the need for this diagnostic approach. Large field experiments testing vaccination messages showed that interventions favored by intentions or expert expectations did not necessarily outperform simpler reminders in actual uptake, whereas previously field-effective approaches transferred more successfully [33, 34]. Intermediate psychological responses therefore cannot substitute for behavioral validation.

Communication can also generate unintended consequences. Corrections may reduce belief in misinformation while increasing broader skepticism, and effects can vary substantially across countries and information environments [34]. Moreover, the population impact of vaccine-skeptical content depends not only on the persuasiveness of individual messages but also on how frequently people encounter them [35]. An intervention that successfully corrects a highly salient false claim may consequently have little population effect if the broader exposure environment remains unchanged.

The model therefore predicts that effective intervention matching should begin with diagnosis of the operative pathway: threat appraisal, collective meaning, network exposure, institutional credibility, or opportunity. Evaluation should then measure the outcome nearest to the intervention's intended mechanism while retaining observed behavior as a distinct endpoint whenever behavioral change is claimed. Longitudinal tests should examine whether altering one domain changes others through feedback rather than assuming independent effects.

Results and Discussion

The behavioral ecology developed here addresses a recurring problem in prevention research: very different pathways can produce the same observable action. Failure to vaccinate, screen, test, isolate, or adopt another preventive behavior may reflect low perceived risk, unfavorable response beliefs, social opposition, institutional distrust, inaccessible services, or combinations of these conditions. Conversely, participation can occur despite ambivalence through convenience, routine, requirements, or strong social expectations. Behavioral outcomes therefore provide incomplete evidence about the psychological process that produced them.

The article's contribution is not to replace established behavioral theories with an all-encompassing ecological construct. Rather, it specifies how their explanatory variables become conditional when embedded in relational and institutional environments. Evidence supporting social identity, norms, risk appraisal, network influence, trust, and opportunity does not establish that the five-domain model presented here is itself causal or predictively valid. The integrated architecture is a proposed synthesis.

Several limits are substantial. Much of the evidence selected to develop the model arose from COVID-19 and vaccination contexts. Mechanisms involving collective risk, politicization, emergency communication, and infectious-disease externalities may be less important for screening, medication prevention, diet, physical activity, or other behaviors. Social influence also differs across health decisions [23]. Transfer beyond vaccination therefore requires direct testing rather than analogy.

Measurement creates another limitation. Studies frequently assess intention, self-reported behavior, perceived norms, trust, or information exposure at different analytical levels. A country-level cultural measure cannot establish an individual psychological mechanism, network similarity cannot prove interpersonal diffusion, and a change in belief accuracy cannot establish behavioral benefit. These distinctions are central because ecological explanations become unfalsifiable if every variable is allowed to stand for every other level.

Equity is equally central. Structural disadvantage should not be inserted into the model as another individual "barrier." Language access, service design, institutional responsiveness, work conditions, transport, digital access, and prior experiences with authority shape which actions are realistically available. At the same time, demographic group membership cannot be used to infer distrust, identity, risk perception, or motivation. The model therefore treats power and resources as conditions affecting pathway availability, not as psychological attributes of populations.

Future validation should compare the proposed pathways prospectively. Longitudinal designs could test whether changes in visible participation alter norms and subsequent action. Network studies could separate diffusion from homophily and shared exposure. Field experiments could compare communication with opportunity-changing interventions after identifying the hypothesized binding constraint. Cross-cultural work should distinguish contextual normative climates from individual perceived norms, while implementation research should examine whether institutional responsiveness changes both opportunity and credibility. The strongest test would be failure. If interventions targeted to a correctly identified ecological constraint do not outperform mismatched interventions, or if domain interactions do not improve explanation beyond simpler models, the proposed architecture should be revised. A behavioral ecology is useful only if context dependence

can be translated into falsifiable distinctions rather than serving as a general claim that “everything matters.”

Conclusion

Preventive health action is neither purely individual choice nor a deterministic product of social context. It emerges within an environment in which risk is interpreted, behavior carries collective meaning, information moves through relationships, institutions acquire or lose credibility, and opportunities to act are unequally distributed. The proposed Behavioral Ecology Model of Prevention keeps these domains separate while explaining why their alignment or conflict can produce different behavioral pathways. Its principal implication is diagnostic: the same observed non-action can arise from different constraints, and the same intervention can therefore succeed in one ecology yet fail in another. The model remains theoretical and requires empirical testing across prevention types, populations, institutions, and time. Its value will depend on whether those tests can distinguish genuine contextual mechanisms from descriptive complexity.

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