

The Mathematics of Democratizing Care

From theoretical combinations to feasible pathways, equitable access and completed care

RESEARCH LENS	SCOPE
International / Quantitative methods / Cross-specialty	Combinatorial models, source validation, access measurement and reproducible evaluation
Central question	How can this field advance the democratization of care?
Evidence cutoff	October 2, 2026

Democratization of care means expanding people's practical ability to obtain appropriate, affordable care, exercise informed choice and participate in decisions that affect them.

An AI-assisted academic working paper. General subject-matter research; no original participant data or independent peer review. Empirical evidence, mathematical results, assumptions and proposed evaluations are distinguished in the text.

Abstract & validation findings

Research question. How can mathematical models of care coordination support the democratization of care without confusing a large space of possible combinations with accessible services, observed demand or economic value? This paper develops a general framework connecting combinatorics, workflow measurement and distributional evaluation. Its primary objective is to make access claims more testable.

Methods. A targeted source audit recalculated the equations in a preliminary 19-page care-flow model, examined two supporting provider-universe tables and checked selected external benchmarks against their primary sources. Integer multiplication, unit analysis and source-to-claim reconciliation were used. No participant-level dataset, platform deployment or empirical treatment effect was evaluated.^{[1][3][8]}

Results. The central expression, $6.5 \text{ billion} \times 800 \times 300 \text{ million}$, equals 1.56×10^{21} , or **1.56 sextillion**, in short-scale English. It does not equal 1.65 sextillion. The result is a count of unconstrained labeled tuples. The current taxonomy file used for comparison contains 883 unique codes; the scenario's 800 is a hypothetical parameter. The 19 visible provider-category ranges sum to 392–632 million, not the reported 392–633 million. Neither correction establishes a valid global provider population.^{[5][8]}

Interpretation. The central arithmetic is reproducible; the empirical population, catalogue and deduplication assumptions are not independently validated. Counts of potential configurations do not measure unmet need, care capacity, completed care, market size or revenue. A more useful evaluation separates raw configurations, feasible pathways, chosen actions, completed care and their distribution across people.

Public-interest contribution. Democratization is operationalized as expanded practical access to appropriate and affordable care, informed choice, and meaningful participation. The proposed measures preserve people who remain offline, lack a feasible option or abandon a journey. The framework permits a finding of no benefit or unequal benefit; it does not assume that technological expansion produces inclusion.

Validated conclusion: 1.56 sextillion is correct for the stated hypothetical inputs. A claim that this number establishes the size or value of a care market is not supported.

1. Scope, evidence and audit method

The source model is treated as an object of examination, not as independent corroboration of its own assumptions. Its original scope combines health services with personal, family and other care activities. Those domains may share scheduling or communication infrastructure, but they require different definitions of need, appropriateness and outcomes. An expansive care concept cannot justify merging incompatible statistics.

The audit followed four steps. First, each displayed calculation was transcribed with its unit and time basis. Second, arithmetic was independently recalculated. Third, externally attributed numbers were checked against the cited institution's material where accessible. Fourth, conclusions were assessed for whether the arithmetic and sources actually entail them. A correct equation can still support an invalid interpretation.

Evidence class	Meaning in this paper	Permissible use
Exact calculation	Reproduced from stated numerical inputs	Conditional mathematical result
Source-verified benchmark	Number located in a primary publication	Context with its original definition
Planning assumption	Input supplied without an empirical sampling basis	Explicit scenario or sensitivity analysis
Proposed evaluation	Original analytical design	Future research, not an observed effect
Unresolved claim	Method or evidence insufficient to reproduce	Retain uncertainty; do not promote to fact

The review is targeted rather than systematic. It does not estimate the completeness of the literature or perform a meta-analysis. Primary materials include an ITU release, the NUCC taxonomy CSV, a CAQH presentation, China's national statistical communiqué, a WHO workforce page and a Google corporate statement. Institutional statistics, standards and vendor statements have different evidentiary roles.^{[4][5][6][7][9][10]}

This AI-assisted working paper has not undergone independent peer review. Its equations are reproducible, but the proposed study designs have not been implemented. Mathematical findings and empirical uncertainty are kept separate throughout. Public dissemination should retain these distinctions when a table or headline is excerpted.

2. Define the unit before counting

A person, clinician, organization, facility, product identity, seller offer, appointment and administrative message are different units. They can be related without being interchangeable. Many people may use one organization; one clinician may work at several sites; one product may have many offers; one encounter may generate multiple administrative messages. Counting relationships requires an explicit data model.

Let U be a defined population of people, L a vocabulary of care labels and P a set of product identities. The Cartesian product $U \times L \times P$ contains ordered triples (u, l, p) . Its cardinality is the product of the three set sizes. This formal rule does not require statistical independence: it defines all combinations. The problem arises when every combination is subsequently treated as relevant, permissible, available or valuable.

Symbol	Unit	Necessary definition
$N = \text{size of } U$	People	Population, geography, date and inclusion rule
$K = \text{size of } L$	Labels	Vocabulary version and treatment of inactive entries
$P = \text{size of product set}$	Product identities	Identity rule, category boundary and deduplication
V	Providers or service units	Person, organization and location kept separate
E	Events	Event type, status, identity and reporting period
R	Revenue	Currency, period and recognition rule

A combinatorial count has no currency unit and no time unit unless one is explicitly introduced. Multiplying people by labels by products does not produce dollars per year. Adding an annual request rate creates a rate model with different units and a different interpretation. Neither transformation should be left implicit.

Counting also depends on identity. A reclassified provider, updated product description or retried network request should not automatically create a new underlying entity or completed service. The model needs stable keys and versioned attributes. Where identities cannot be resolved reliably, publish the uncertainty instead of reporting a falsely precise total.

For democratization research, the unit should ultimately return to people and their needs. A person represented in millions of candidate tuples may have no affordable, available or appropriate option. The number of tuples associated with that person cannot establish access.

3. Reproducing the sextillion calculation

The preliminary model assumes $N = 6,500,000,000$ people, $K = 800$ labels and $P = 300,000,000$ products. Multiplying the first two values gives 5,200,000,000,000 person-label pairs. Multiplying by the product assumption gives 1,560,000,000,000,000,000 triples. In scientific notation this is 1.56×10^{21} .^[3]

Expression	Recalculated result	Interpretation
$N \times K$	5.2×10^{12}	Person-label pairs
$N \times P$	1.95×10^{18}	Person-product pairs
$N \times K \times P$	1.56×10^{21}	Person-label-product triples
$(N \times K \times P) / (6.5 \times 10^{12})$	240,000,000	Numerical ratio to a separately stated comparator

The 240-million-fold comparison is arithmetically correct if the denominator is exactly 6.5 trillion. It is not a like-for-like growth rate when the numerator and denominator count different kinds of objects. If the comparator is instead 6.4 trillion, the ratio is 243.75 million. A presentation should not switch between the two denominators while retaining the same ratio.

The initially requested 1.65 sextillion is not generated by the supplied inputs. It exceeds 1.56 sextillion by 90 quintillion, or approximately 5.77% relative to 1.56. No empirical significance follows from that difference: both numbers would remain theoretical configuration counts unless the input sets and the meaning of admissible relationships were established.

Scientific notation is preferable when the audience spans naming conventions. Here, sextillion means 10^{21} , quintillion means 10^{18} and trillion means 10^{12} . These are short-scale English definitions. Exact integers or powers of ten reduce ambiguity in international publications.

Publication rule. Retain 1.56 sextillion only with the phrase “under the stated hypothetical inputs” and identify the counted object. The number may illustrate the combinatorial scale of a search problem. It should not headline an estimate of accessible care, economic demand or social benefit.

4. Population and taxonomy validation

The population assumption of 6.5 billion is not the ITU's 2025 estimate of internet use. ITU reported approximately 6.0 billion people online and 2.2 billion offline. The 6.5 billion value can be retained as a scenario, but it should not be attributed to that release. Using 6.0 billion while holding the other assumptions fixed produces 1.44×10^{21} configurations, a 7.6923% reduction.^[4]

Online population is not equivalent to reachable service users. Connectivity quality, affordability, skills, language and practical access can constrain participation. A person's inclusion in an online population estimate also does not establish consent, need or ability to complete a particular care workflow. Conversely, assisted and offline routes can reach people outside a digital-user denominator.

The NUCC download page identifies version 26.1, dated July 1, 2026. The retrieved CSV contains **883 data rows and 883 unique values in its Code field**. This audit counts identifiers in that particular file. It does not interpret them as 883 mutually exclusive global care sectors or 883 types of independent provider.^[5]

Parameter choice	Result with 6.5B people and 300M products	Status
800 labels	1.56 sextillion	Original rounded scenario
883 code identifiers	1.72185 sextillion	Mechanical substitution of retrieved file count
Difference	0.16185 sextillion; +10.375%	Sensitivity to vocabulary size

Increasing a taxonomy's granularity can raise a configuration count without creating any additional service capacity. Splitting one label into two may double some tuples while leaving the underlying people, providers and products unchanged. The count is therefore sensitive to representation as well as to the real world.

A defensible model should state whether it uses classifications, specializations, active codes or a separately constructed international vocabulary. It should preserve the release used and document inclusion rules. A taxonomy is useful for organizing information; its size is not an independent measure of care opportunity.

5. Provider denominators and overlap

The supporting provider table contains 19 category ranges spanning healthcare and adjacent care activities. Adding their displayed lower endpoints yields 392 million. Adding their displayed upper endpoints yields 632 million. The summary reports 392–633 million or more. The one-million upper-end discrepancy is a reproducible arithmetic issue; a plus sign does not supply a method for resolving it.^[8]

Correcting the sum does not validate the categories. The table combines workers, organizations and facilities, uses broad overlapping sectors and does not provide the source years or entity-level linkage needed to reconstruct a global count. A hospital, its workforce and its service locations may all appear in related categories. They cannot be assumed to represent distinct potential buyers or distinct care capacity.

The companion opportunity document supplies an overlap-adjusted 300–450 million universe and a 190–280 million fragmented or weakly digital subset. No auditable record linkage, sampling procedure or adjustment equation establishes those ranges. They remain planning hypotheses. They should not be described as observed, unique or addressable populations.^[1]

Counting problem	Consequence	Necessary remedy
People mixed with organizations	Unit mismatch	Separate entity tables
Multispecialty participation	Duplicate category membership	Stable identifiers and overlap rules
Several sites under one owner	Locations differ from purchasing accounts	Parent-location relationships
Unobserved digital maturity	Unsupported opportunity percentages	Defined instrument and representative sampling
Broad adjacent-care boundary	Incompatible sector definitions	Publish scope and crosswalk

WHO's workforce page reports an estimated stock exceeding 70 million health workers. That is a differently defined population and cannot validate or directly refute a much broader tally including non-healthcare activities. Its value here is methodological: an authoritative benchmark must retain its own population and unit.^[10]

Democratization also requires avoiding an exclusive focus on large institutional buyers. Small providers, informal support networks and community organizations can matter greatly for practical access. Their inclusion should be justified by the research question and measured carefully, rather than achieved by summing incomparable counts.

6. Catalogue size is not care availability

The 300-million-product input is a hypothesis, not a verified inventory. The source model also mentions European normalized-product and SKU ranges and broad retail-offer volumes. This audit did not locate a reproducible extraction, product boundary or normalization procedure that establishes those estimates. They should remain outside any empirical headline.^[3]

A product identity differs from a stock-keeping unit, a package, a variant, an offer and a listing. One product may have several package sizes, sellers, currencies and delivery options. Counting each as a separate product can inflate the apparent opportunity. Conversely, treating materially different formulations or specifications as identical can create unsafe or inappropriate matches.

Google stated in January 2026 that its Shopping Graph contained more than 50 billion product listings. That corporate statement supports a claim about Google's reported listing scale. It does not establish the number of unique care products, the availability of any particular item or the size of a healthcare market.^[9]

Catalogue object	Example distinction	Research implication
Product identity	A defined item or service specification	Establish equivalence rules
Variant or package	Size, formulation or quantity	Preserve meaningful differences
Seller offer	Price and terms from one seller	Count availability separately
Listing	Published representation of an offer or item	Check duplicates and freshness
Fulfillment route	Delivery or collection option	Add location and capacity constraints

For care access, the relevant question is whether a suitable option can actually be obtained under the person's conditions. Stock status, delivery coverage, eligibility, affordability and appropriate professional oversight may all matter. A catalogue containing a product is weaker evidence than a successful, verified fulfillment event.

An empirical catalogue study should publish the extraction date, participating sources, coverage exclusions and duplicate resolution rules. Estimate accuracy on a reviewed sample and report missingness. Where access to commercial data is restricted, the research should disclose that limitation rather than extrapolate a global count from a small or selected catalogue.

7. From raw tuples to feasible pathways

Let X be the raw configuration set. For each configuration x , define $I(x) = 1$ only if the relevant constraints are satisfied at the time of evaluation, and 0 otherwise. The feasible count is the sum of $I(x)$ across X . It cannot be recovered from the raw count alone. In particular, multiplying unrelated percentages is not justified when their conditioning populations differ.

A constraint may concern clinical suitability, authorization, geography, language, price, capacity or timing. Some constraints are hard requirements; others reflect preferences that a person may choose to trade off. These should be modeled separately. A ranking score must not compensate for failure of a required safety or eligibility condition.

Layer	Question	Example evidence
Relevance	Does this option address the expressed need?	Defined task and reviewed matching logic
Permission	May this action and information use occur?	Applicable authority and verified roles
Feasibility	Is the option available under actual constraints?	Capacity, geography, eligibility and timing
Choice	Does the person select the option knowingly?	Understandable alternatives and preferences
Completion	Did appropriate care or fulfillment occur?	Reconciled event and outcome record

These layers can interact. A provider's specialty constrains the relevant product set; a payer's network constrains payment options; a product may require professional authorization. Such dependencies mean that an unconstrained Cartesian product can be extremely loose. The formal upper bound remains mathematically valid while offering little predictive value.

Let $F(u)$ be the set of feasible options for person u . A useful coverage measure is the proportion of the defined population for whom the size of $F(u)$ is at least one. Report the distribution of that size, including zeros. The average number of options can conceal a large excluded group if a small well-served group has many alternatives.

Practical democratization requires both feasible choice and the ability to act on it. Therefore, measure assistance, comprehension and completion as well as option counts. A technically feasible appointment is not effectively accessible if the person cannot understand the instructions or obtain necessary transport.

8. Branching, capacity and workflow states

The preliminary branching example assumes 20 providers, 10 slots, four payment routes, eight offers, three fulfillment routes and two follow-up options. Their product is **38,400**. Adding three communication channels yields **115,200** labeled presentation variants. Both calculations are correct under the stated assumptions; neither count is a demand estimate.^[3]

The 38,400 result assumes every selected dimension can combine with every other one. If only two payment routes are available for a particular provider, or an offer has only one fulfillment method, the actual feasible count is lower. Shared capacity also matters: many apparently distinct paths may compete for the same appointment slot.

Care workflows often contain loops. A missing document can trigger a request, a revision and another submission. Counting all possible walks through a graph without bounding repetitions can produce an unbounded set even when the number of states is finite. A useful model therefore defines a time horizon, stopping rules, maximum retries and the treatment of equivalent paths.

Quantity	What it measures	What it cannot establish alone
States	Distinct recorded workflow conditions	Completed care
Transitions	Changes between conditions	Unique people served
Paths	Ordered sequences of transitions	Independent capacity
Presentation variants	Channels or renderings of an option	Additional demand
Completed episodes	Reconciled outcomes within a definition	Causal benefit of the intervention

A queueing perspective complements combinatorics. If scheduling demand exceeds available clinical capacity, a better matching system may redistribute waiting without increasing completed care. A study should measure arrival patterns, capacity, abandonment and delays rather than assume that more visible options remove the bottleneck.

For public-interest evaluation, technology is useful when it makes appropriate pathways feasible or easier to complete. A reduced number of candidate branches can be beneficial if it removes misleading or ineligible options while preserving informed choice. Maximizing the raw number of branches is therefore not an appropriate objective.

9. Annual activity and event accounting

A distinct model estimates administrative actions per year: $A = N_{\text{active}} \times r_{\text{month}} \times 12 \times a_{\text{request}}$. Here N_{active} is the number of active people, r_{month} is requests per person per month and a_{request} is actions per request. Units cancel to actions per year. This is a scenario model until every input has an empirical basis.

Active population and usage	Calculation	Annual actions
6.5B; 1 request/month; 3 actions/request	$6.5B \times 1 \times 12 \times 3$	234 billion
6.5B; 4 requests/month; 6 actions/request	$6.5B \times 4 \times 12 \times 6$	1.872 trillion
6.5B; 10 requests/month; 10 actions/request	$6.5B \times 10 \times 12 \times 10$	7.8 trillion
6.5M; same three usage assumptions	0.1% of the population above	234M; 1.872B; 7.8B

These values reproduce the source model's arithmetic.^[3] Treating the whole planning population as active is a strong assumption. A realistic model should use observed cohort activity, seasonality and a defined activity threshold. An internet-user count should not silently become an annual active-customer count.

An action can be a message, lookup, verification or submission. Several actions may support one episode. Duplicate requests and retries can inflate action volume without benefiting anyone. Research should therefore keep technical events, administrative cases, service episodes and people in separate linked tables.

If consumer, provider and payer systems all record the same underlying event, adding their totals double-counts it. The cardinality of a union requires overlap information. For two event sets, $\text{size}(A \cup B)$ equals $\text{size}(A)$ plus $\text{size}(B)$ minus $\text{size}(A \cap B)$. For more sets, either apply a complete reconciliation method or use an event identity that prevents duplicate counting.

High action volume is an infrastructure-load scenario, not inherently a public benefit. Efficient coordination might reduce the number of actions needed per completed episode. Report both workload and outcomes so that increased system activity is not mistaken for improved access.

10. What external benchmarks establish

The CAQH presentation for the 2025 Index displays 68.8 billion medical and 5.2 billion dental administrative transactions. Their sum is 74.0 billion. The presentation's chart labels these values by Index edition; the associated 2025 Index release identifies 2024 as the underlying period. These are administrative transaction estimates, not unique encounters, people or care pathways.^{[6][2]}

CAQH also explains that transactions may repeat or be triggered by different events. Its transaction universe includes processes such as eligibility verification, claims and remittance. The benchmark can contextualize administrative scale, but it cannot be added to clinical encounters as though both were the same unit. The underlying microdata and estimation model were not reanalyzed here.

China's National Bureau of Statistics reports 10.58 billion medical visits in 2025. Its note 81 includes outpatient services, emergency treatment, home visits, appointment-based diagnosis and treatment, specified examinations and consultation or guidance, with stated exclusions. The number refers to visits, not 10.58 billion distinct people.^[7]

Benchmark	Verified statement	Boundary
ITU, 2025	Approximately 6.0B people online	Connectivity estimate, not care demand
CAQH, 2025 Index	68.8B medical + 5.2B dental transactions	US administrative activity; underlying 2024 period
China NBS, 2025	10.58B medical visits	National visit definition and reporting period
WHO workforce page	Estimated stock exceeds 70M health workers	Health-worker population, not all adjacent care
Google, January 2026	More than 50B product listings reported	Corporate retail listing count

These benchmarks illustrate why a single global care-flow total cannot be formed by addition. They differ in geography, year, population, unit and measurement method. A research dashboard may present them in separate panels with explicit labels; a summed total would lack a coherent meaning.^{[4][6][7][9][10]}

The evidence supports a qualitative conclusion that care and its administration operate at substantial scale. It does not validate any particular platform's reachable population, product coverage, integration capability or revenue. Those require separate measurements tied to actual arrangements.

11. A distributional model of access

Democratization of care concerns the distribution of effective opportunities. Let D be the number of people with a defined relevant need during a specified period. Let C be the number who obtain appropriate care within the chosen interval. Then C/D is a completion proportion. The denominator must include eligible people who never start a digital journey when they belong to the target population.

Let C_g/D_g describe a prespecified group g . Report each proportion, its uncertainty and the absolute difference between relevant groups. A system-wide average can rise while the lowest-access group experiences no benefit or deteriorates. Groups should be selected with substantive justification and lawful, proportionate data collection; small samples and missing data must be visible.

Outcome	Proposed definition	Essential qualification
Effective option coverage	People with at least one feasible option / people with relevant need	An option must be usable, not merely listed
Timely completion	Appropriate completion within interval / eligible need	Define the interval and ascertainment method
Affordability	Full patient burden relative to a stated resource measure	Include non-price burdens where measurable
Informed agency	Comprehension, meaningful alternatives and supported choice	Respect informed refusal
Exclusion gap	Difference in effective access across groups	Report uncertainty and contextual causes

A simple transition example illustrates the distinction. If 80% find an appropriate option, 75% of those can book and 80% of those attend, overall attendance is 48%. Improving discovery to 90% raises it to 54% if the conditional booking and attendance proportions remain unchanged. This is a hypothetical six-percentage-point gain, not an empirical effect or a relative 6% improvement.

The calculation assumes compatible conditional denominators. Multiplying separately measured marginal rates from different populations is not justified. A real longitudinal dataset should record the same journey cohort through the stages and preserve repeated attempts, changes of preference and missing outcomes.

A public-interest study should also report burden and harm. A completed encounter may still be inappropriate, unaffordable or inconsistent with the person's priorities. Completion is a necessary operational measure for many pathways, but it is not a universal substitute for quality, autonomy or welfare.

12. Ranking without erasing agency

The source model proposes affordability, transparency, accessibility and quality as dimensions of ranking. These are useful topics for inquiry, but a named score is not a validated instrument. Each dimension needs an operational definition, a reliable measurement procedure and an account of whose preferences determine its weight.^[3]

A generic weighted score can be written $S(x) = \text{sum of } w_j \text{ times } z_j(x)$, after required eligibility conditions have been satisfied. The z_j values must use documented scales; otherwise a variable with a large numeric range can dominate the result accidentally. Weights should not be interpreted as objective social truth or inferred solely from commercial engagement.

Some attributes should be treated as constraints. An option that fails a required safety condition should not become eligible because its price is low. Other attributes may reasonably be preference-sensitive. A person may prefer a familiar provider over a shorter journey, or choose an accessible communication mode over a marginally earlier appointment.

Ranking issue	Failure mode	Proposed research safeguard
Scale and normalization	Arbitrary numeric range dominates	Publish transformations and sensitivity
Missing information	Unknown quality is treated as poor quality	Separate missingness from adverse evidence
Commercial incentives	Paid placement alters apparent relevance	Label sponsorship and audit ranking behavior
Group differences	Average preferences override accessibility needs	Support individual constraints and subgroup evaluation
Uncertainty	A precise score conceals weak evidence	Display material uncertainty and alternatives

Participatory evaluation should involve people who face the relevant barriers, including users of assisted and offline channels. Researchers should document how feedback changes the system rather than merely count consultation participants. The goal is not to manufacture consensus but to make trade-offs visible and contestable.

The relevant outcome is whether ranking helps people make informed choices and obtain suitable care under their circumstances. Click-through rate, time in an application or the number of agent actions may be useful operational diagnostics. They are not sufficient measures of democratization or care quality.

13. Economic sustainability and public benefit

A configuration count cannot be converted into revenue by attaching an arbitrary value to every tuple. Revenue requires an actual transaction, contractual basis, price, collection probability, recognition period and cost structure. Even a completed service can produce no revenue for a coordination operator, while still delivering substantial public value.

For a subscription model, a basic annual revenue scenario is eligible accounts $\times$ reachable fraction $\times$ enabled fraction $\times$ paid conversion $\times$ annual price. The fractions must be conditional in sequence. For a transaction model, use reconciled eligible events $\times$ net revenue per event. Do not treat gross payment volume or the full price of a care service as the operator's revenue without a justified accounting basis.

Costs include integration, verification, support, security, dispute handling and operational maintenance. The same saved staff hour cannot simultaneously be removed from payroll and redeployed to deliver additional appointments without an explicit allocation. Similarly, payment fees and marketplace commissions can overlap contractually; revenue lines need reconciliation.

Perspective	Appropriate question	Distinct from
Patient	Does total burden fall and meaningful choice expand?	Operator revenue
Provider	Does participation remain affordable and useful?	Number of listings
Public funder	What access or health benefit is achieved per full cost?	Gross transaction volume
Operator	Can the service sustain necessary operations?	Total industry expenditure
Community	Who remains excluded and who has influence?	Average utilization

A generic research framework should compare institutional arrangements rather than assume one commercial model. Public procurement, shared infrastructure, community provision and private services can allocate costs differently. Their relative value depends on local conditions and observed outcomes, not on the magnitude of an unconstrained mathematical universe.

The original company's financing and revenue scenarios are outside this public subject-matter paper. They do not validate the combinatorial model and are unnecessary to explain democratization. Public economic claims should instead identify the beneficiary, resource use, time horizon and counterfactual for each proposed benefit.

14. Sensitivity and uncertainty

For $M = N \times K \times P$, changing one input by a given percentage changes M by the same percentage when the others are held fixed. This is a property of the formula, not evidence that inputs are accurately known or vary independently in the world. Simultaneous changes multiply, and structural uncertainty can dominate numeric sensitivity.

Product assumption, with $N = 6.5B$ and $K = 800$	Configuration count	Status
1 million	5.2×10^{18} ; 5.2 quintillion	Hypothetical
10 million	5.2×10^{19} ; 52 quintillion	Hypothetical
100 million	5.2×10^{20} ; 520 quintillion	Hypothetical
300 million	1.56×10^{21} ; 1.56 sextillion	Hypothetical

These calculations reproduce the original sensitivity table.^[3] A range of scenarios is not a statistical confidence interval. Without a sampling design, probability model or defensible distribution over inputs, assigning a confidence level would be misleading. A Monte Carlo simulation built on arbitrary distributions would not solve that evidence problem.

The provider-expanded expression $N \times V \times P$, with V between 300M and 450M, gives 5.85×10^{26} to 8.775×10^{26} . Multiplying by 800 gives 4.68×10^{29} to 7.02×10^{29} . These arithmetic results are correct for the supplied assumptions. However, provider identity and taxonomy membership are related; treating every provider-label pairing as valid greatly inflates the candidate space.

Structural sensitivity should therefore examine the model itself: alternative entity definitions, deduplication rules, feasible relationships and time horizons. A smaller but well-defined feasible set may be more informative than a vast unconstrained count. Publish which conclusions survive these changes and which depend on a particular representation.

For democratization, sensitivity should also examine exclusion. Recalculate access measures when offline people are included, when missing outcomes are treated under plausible alternatives and when the cost of human assistance is counted. These choices can change the practical conclusion even when the combinatorial arithmetic remains identical.

15. A prospective validation program

A useful empirical study begins with one bounded care pathway and a defined population. Select an outcome that matters to participants, such as timely completion of an appropriate referral, and establish baseline barriers. The intervention may combine technical exchange, navigation and assistance; the evaluation should identify which components are delivered and to whom.

A feasibility phase should test data quality, outcome ascertainment and operational safety. It should not be presented as definitive proof of effectiveness. A subsequent comparative design can estimate outcomes against a credible alternative, with the design chosen to fit ethical and operational conditions. Randomization, phased introduction and well-specified observational comparisons have different assumptions that must be made explicit.

Study component	Required record	Public-interest purpose
Target population	Inclusion, geography, need and period	Preserve the denominator
Baseline barriers	Affordability, capacity, language and administration	Identify the mechanism of exclusion
Intervention exposure	Actual components and assistance received	Distinguish assignment from use
Outcomes	Completion, burden, quality and agency	Test benefit beyond technical activity
Distribution	Prespecified groups and missingness	Detect unequal benefit
Full cost	Patient, provider, operator and public resources	Assess sustainability and trade-offs

Sample size should follow an explicit estimand, meaningful effect size, baseline variability and design. This paper supplies no invented power calculation. Account for clustering, repeated journeys and attrition where relevant. Report uncertainty rather than relying only on whether a threshold for statistical significance is crossed.

Predefine how adverse effects, inaccessible workflows and failed handoffs will be handled. Participants need support while the study operates, not only a retrospective incident count. Meaningful community involvement can help choose outcomes and identify burdens that administrative datasets overlook.

The eventual publication should include negative findings, intervention changes and the conditions required for success. Evidence from one regional pathway may justify a second study; it does not establish universal effectiveness. Democratization is a continuing distributional question as services scale and institutional conditions change.

Appendix A. Claim-by-claim disposition

The following register summarizes the mathematical audit of the preliminary source. “Reproduced” refers to arithmetic, not empirical validation. “Source verified” means the stated benchmark was located in the primary material, without reanalyzing the institution's underlying dataset.^[3]

Source claim	Audit result	Public treatment
6.5B × 800 × 300M	1.56 sextillion reproduced	Hypothetical raw configurations
1.65 sextillion	Not generated by stated inputs	Correct to 1.56 for that scenario
800 taxonomy labels	Retrieved version 26.1 has 883 unique codes	Identify 800 as an assumption
392–633M provider summary	Visible endpoints total 392–632M	Correct arithmetic; population still unverified
300–450M unique providers	No reproducible deduplication method	Unvalidated planning range
300M products and regional ranges	No verified normalized inventory	Hypotheses, not measured counts
38,400 branches; 115,200 channel variants	Multiplication reproduced	Conditional configurations, not demand
Annual action scenarios	All six displayed totals reproduced	Assumed activity rates and population
74.0B administrative transactions	68.8B + 5.2B source verified	CAQH scope and underlying period retained
10.58B medical visits	NBS source verified	China, 2025, visit definition retained
More than 50B retail listings	Google statement located	Corporate listing claim, not unique care products
Provider-expanded counts	Arithmetic reproduced	Dependent dimensions and unknown inputs
Affordability/access/quality ranking	No validation study supplied	Proposed framework requiring evaluation
Economic claims from size	Not established by the equations	Exclude as a mathematical finding

The source's useful contribution is the separation of a possibility space from feasible and observed activity. Its limits arise where unsupported inputs or strategic interpretations are allowed to carry more evidentiary weight than the arithmetic permits. Public reuse should preserve both observations.

Appendix B. Reproduction specification

The minimal calculation record should retain the exact inputs, their units, provenance and observation dates. Integer arithmetic is sufficient for the main configuration counts. Percentage comparisons should identify their denominator and rounding policy. Keep full precision in calculations and round only the displayed result.

Check	Reproduction instruction	Expected result
Central expression	$6,500,000,000 \times 800 \times 300,000,000$	1,560,000,000,000,000,000,000
Current taxonomy file	Count non-header rows and distinct Code values	883 rows; 883 unique codes
Mechanical taxonomy substitution	$6,500,000,000 \times 883 \times 300,000,000$	1.72185×10^{21}
Population alternative	$6,000,000,000 \times 800 \times 300,000,000$	1.44×10^{21}
Provider table	Sum 19 displayed lower and upper endpoints separately	392M; 632M
Conditional branch example	$20 \times 10 \times 4 \times 8 \times 3 \times 2$	38,400
Channel variant example	$38,400 \times 3$	115,200
Reference transaction sum	$68.8B + 5.2B$	74.0B

The provider lower endpoints, in millions, are 1, 55, 4, 8, 7, 10, 5, 60, 8, 65, 20, 25, 3, 70, 2, 15, 2, 7 and 25. The corresponding upper endpoints are 2, 70, 7, 15, 12, 20, 10, 90, 15, 100, 35, 40, 7, 110, 4, 30, 5, 15 and 45. These reproduce the table audit while making no claim that the underlying estimates are reliable.^[8]

A future empirical package should add permitted source snapshots, a transformation log, entity-resolution rules, missingness reports and a versioned outcome dictionary. Data access restrictions may prevent public release of sensitive records; reproducibility can still be supported with documented methods, aggregate checks and appropriately controlled review.

The current source audit does not include independent peer review, a complete worldwide catalogue census, provider-level deduplication or a deployment study. Those are distinct research tasks. Updating a source value should trigger a new model version and an assessment of whether the conceptual interpretation also changes.

Conclusions and research priorities

The central multiplication is correct at 1.56 sextillion under the original hypothetical inputs. The same audit identifies a taxonomy mismatch and a one-million discrepancy in the provider-table upper sum. More fundamentally, it finds that several population and catalogue assumptions lack a reproducible empirical basis. Correcting arithmetic cannot repair missing definitions or evidence.

Combinatorial scale can explain why coordination requires filtering, search and careful constraint handling. It cannot establish that every configuration is useful, that an organization can serve it or that a person benefits. The mathematical object must remain visible whenever the number is reused: a labeled tuple is different from a feasible option, a completed episode and a unit of revenue.

Democratization of care provides a more demanding objective than maximizing a catalogue or a transaction count. Research should establish whether people with a relevant need gain practical access to appropriate and affordable services, whether they retain meaningful choice, and whether benefits extend to those who previously faced the greatest barriers.

The next empirical priorities are therefore to define one population and care pathway; measure feasible options including the absence of any option; track complete journeys and full burdens; compare outcomes under a credible design; and report the distribution of benefit and harm. Small providers and community organizations should be evaluated as participants with real integration costs, not merely as entries in a global universe.

The proposed framework is applicable across institutional and technical arrangements. It does not require adoption of a particular vendor, agent architecture or commercial model. Its contribution is a disciplined sequence of questions: what is counted, what is feasible, what is chosen, what is completed, who benefits and at what cost?

Public conclusion: Care is democratized when more people can obtain appropriate, affordable care with meaningful agency. A larger mathematical possibility space is neither necessary nor sufficient evidence that this has occurred.

References & evidence access

Numbered references identify source material supporting nearby factual statements. Interpretation, proposed architecture and labeled scenarios are original synthesis. Web sources were accessed for this review; the evidence cutoff is October 2, 2026. Report dates and underlying observation years are retained separately. No exhaustive database search or formal risk-of-bias meta-analysis was performed.

[1] User-supplied Careverse planning document. Global Interoperability Opportunity by Provider Universe 1(3).pdf. Undated; supplied source reviewed October 2026.

Internal seven-page planning source. No supporting citations or reproducible count methodology identified. Quoted ranges are unverified hypotheses, not external evidence.

[2] CAQH. 2025 CAQH Index Shows U.S. Healthcare Avoided \$258 Billion and Accelerated Automation, Interoperability and AI Adoption. February 19, 2026; 2024 underlying period.

CAQH-issued release distributed by GlobeNewswire. Summary-level review; underlying Index microdata and full calculation model not independently reanalyzed.

<https://www.globenewswire.com/news-release/2026/2/19/3241072/0/en/2025-caqh-index-shows-u-s-healthcare-avoided-258-billion-and-accelerated-automation-interoperability-and-ai-adoption.html>

[3] Careverse internal research revision. The mathematics of a universe of care. September 14, 2026; 19 pages.

Retrieved source: Careverse_Care_Flow_Math_Research_Revision(2).pdf. Pages 2 and 16-17 present the 1.56 sextillion scenario. Planning inputs and unconstrained combinations, not validated market demand.

[4] International Telecommunication Union. Facts and Figures 2025 press release. November 17, 2025.

Official estimate of approximately 6.0 billion people using the internet in 2025 and 2.2 billion offline; not a reachable-care population.

<https://www.itu.int/en/mediacentre/Pages/PR-2025-11-17-Facts-and-Figures.aspx>

[5] National Uniform Claim Committee. Health Care Provider Taxonomy Code Set, version 26.1. July 1, 2026; downloaded October 2, 2026.

Audit of the downloaded CSV: 883 data rows and 883 unique Code values. Count does not imply independent provider categories or a global care-sector classification.

https://www.nucc.org/images/stories/CSV/nucc_taxonomy_261.csv

[6] CAQH. 2026 eSolutions Xchange presentation: 2025 CAQH Index Report. 2026; Index edition 2025, underlying period 2024.

Primary authored presentation, slides 5, 8 and 10. Slide 10 visually checked: 68.8 billion medical and 5.2 billion dental administrative transactions. Underlying data period cross-checked against the CAQH release.

https://s3.amazonaws.com/amo_hub_content/Association361/files/CAQH_2026%20eSolutions%20Xchange%20Slides.pdf

[7] National Bureau of Statistics of China. Statistical Communiqué of the People's Republic of China on the 2025 National Economic and Social Development. February 28, 2026; 2025 observations.

Official HTML retrieved directly. Medical visits: 10.58 billion; see definition in note 81. Visit count is not a count of distinct people.

https://www.stats.gov.cn/english/PressRelease/202602/t20260228_1962661.html

[8] Supplied preliminary provider-universe table. Provider universe stats (1).pdf. Undated; three pages reviewed October 2, 2026.

Planning material; no supporting count methodology supplied. Nineteen category endpoints total 392–632 million, compared with a displayed 392–633 million-plus summary. Neither range is empirically validated.

[9] Google; Sundar Pichai. The AI platform shift and the opportunity ahead for retail. January 11, 2026.

Primary corporate statement reporting over 50 billion Shopping Graph product listings. Corporate metric; not independently audited and not a unique-care-product census.

<https://blog.google/company-news/inside-google/message-ceo/nrf-2026-remarks/>

[10] World Health Organization. Health workforce: key figures. Accessed October 2, 2026.

Official topic page reports an estimated health-worker stock exceeding 70 million. Different unit and scope from mixed adjacent-care provider tables.

<https://www.who.int/teams/health-workforce>