

Does a Count of Vaccine-Conspiracy Statements Measure Misinformation Endorsement? A Construct-Interpretation and Item-Classification Critique

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Changes from Version 1.0

Version 1.0 stated that the supplementary tables had not been independently audited, and scoped several claims accordingly. That audit has now been performed, and the scope condition is withdrawn. The audit confirmed the claims it was intended to test: no item-level endorsement distribution, factor analysis, internal-consistency estimate, or validation of the Japanese-language rendering appears anywhere in the published materials. Where the supplementary tables permit a claim to be stated more precisely, it has been (Sections 7 and 8).

Three additions have been made. Section 5 addresses the single-directional sampling of the content domain and its consequence for the reference stratum. Section 6 addresses the outcome variable: the relationship between the construct named in the article's title and the variable actually measured. Appendix A records discrepancies observed within the supplementary tables during the audit.

No claim made in Version 1.0 has been withdrawn or weakened as a result of the audit.

Abstract

Furuse and Tabuchi report that a majority of respondents classified as endorsing vaccine-related misinformation nevertheless accepted COVID-19 vaccination, and that

determinants of acceptance differ by endorsement status [1]. The finding that belief and behavior do not map one-to-one is useful. However, the article does not establish that its principal exposure variable measures what its label states, and a parallel gap affects the outcome variable.

The seven items are the Vaccine Conspiracy Beliefs Scale (VCBS) [2], and three things changed in transposition — the construct label, the context, and the scoring. Although the new context and coding are described, the article does not evaluate these departures or report a content-classification procedure or construct-specific evidence for the new interpretation [1]. *The construct*: the scale's items were selected for conspiratorial form without documented item-level evidential adjudication, and its reported validation — factor structure, internal consistency, convergence with a measure of generic conspiracy mentality, and criterion prediction of vaccination willingness [2, 3] — nowhere adjudicates the accuracy of any proposition; whether vaccine-conspiracy endorsement extends to misinformation endorsement is asserted by relabeling, not established. *The context*: the validation data were collected among Canadian parents for HPV vaccination, and the scale's developers identified extension to other vaccines, populations and countries as requiring confirmation [2]. *The scoring*: the validated instrument averages seven items into a continuous score, whereas the present study dichotomizes each item and counts endorsements [1, 2]. On a reflective reading, validity evidence for the averaged score does not automatically transfer to the dichotomized count; on an index reading, the misinformation label requires an item-classification basis that is not reported.

The authors concede in their limitations section that the measure reflects a combination of misinformation acceptance, generalized distrust, and critical skepticism toward institutions [1] — yet designate respondents throughout as “misinformation endorsers.” The content domain is also sampled in a single direction: all seven statements allege fabrication, deception or concealment, so the zero-endorsement stratum is defined by non-endorsement of these seven statements rather than by absence of false belief, and neither side of the stratified contrast has been shown to isolate misinformation.

A parallel gap affects the outcome. The article's title names attitude, while the measured outcome combines completed vaccination with stated willingness; 96.0% of respondents classified as accepting were already vaccinated [1]. Standard determinant frameworks in this literature treat uptake and intention as jointly determined by attitudinal, normative and structural components [7, 8]. The article measures none of the normative or structural components, yet invokes precisely such determinants — vaccination access through workplaces and universities, and a wish to resume ordinary social life — when interpreting its most striking result ([1], Discussion). The reported divergence between endorsement and outcome is therefore consistent with more than one interpretation, and the article presents one.

The operational definition of “endorser” also changes between analyses without stated rationale: descriptive analyses use agreement with at least one statement, whereas the stratified regression models compare zero endorsement against two or more. This excludes 1,340 respondents — 43.6% of all respondents endorsing at least one statement [1, 6].

Cross-stratum comparisons are supported by no interaction test in the article and no interaction term in the inspected analysis script [1, 6].

These issues do not undermine the descriptive contribution, but they constrain what the adjusted odds ratios can be said to measure. Conclusions here are stated under the evidential definition of misinformation stipulated in Section 1.

Keywords: construct validity, score interpretation, item classification, outcome definition, vaccine hesitancy, misinformation, measurement, COVID-19, Japan

1. Introduction

Furuse and Tabuchi analyzed the second wave of the Japan COVID-19 and Society Internet Survey (JACSIS), conducted in September–October 2021 among 31,000 panel participants aged 15 years or older, of whom 28,175 provided valid responses [1]. Respondents reported COVID-19 vaccination status or intention and their agreement with seven statements characterized as vaccine-related misinformation. Applying inverse probability weighting, the authors report that 8.1% of vaccinated respondents endorsed at least one statement compared with 36.6% of those unwilling to be vaccinated, and that 63.6% of endorsers were vaccinated or willing to be vaccinated [1].

The observation that endorsement and behavior diverge is worth making, and the stratified analysis is a reasonable design choice. My concern is narrower and prior to the substantive findings: whether the article establishes that its variables measure the constructs their names assert. I argue that it does not, on both the exposure and the outcome side; that the source validation studies allow the exposure-side gap to be documented precisely rather than merely asserted; that the authors partly recognize it; and that the consequences propagate into the terminology, the reported associations, and the policy recommendations.

For the limited purpose of this commentary, “misinformation” is used stipulatively: it requires an evidentially adjudicable content claim — propositional content that can be evaluated as false or unsupported relative to a defined evidence base at the time of measurement. No survey of disciplinary usage is attempted, and the findings below are accordingly conditional on this criterion: what is shown is that the article’s interpretation is unsupported for a measure of evidentially adjudicable content, not that no defensible definition of misinformation could accommodate its usage. Nothing below depends on this commentary adjudicating the truth of any individual survey item. The argument concerns what the article’s reported evidence can and cannot establish relative to that criterion.

This is a methodological critique. It takes no position on the epidemiological merits of COVID-19 vaccination, and nothing here should be read as disputing the effectiveness or safety findings of the wider literature. Section 6 concerns whether determinants named by the authors were measured; it makes no claim about the character of the institutional environment in Japan in 2021, and no such claim is required for the argument.

This extended critique does not seek retraction or claim that the reported numerical results are invalid. Its purpose is to place on record a set of unresolved methodological objections concerning construct interpretation, item classification, scoring, outcome definition, and cross-stratum inference.

2. What changed in transposition: construct label, context, and scoring

The seven statements are reproduced in the article's Table 1 [1]:

- A. Vaccine safety data is often fabricated.
- B. Immunizing children is harmful and this fact is covered up.
- C. Pharmaceutical companies cover up the dangers of vaccines.
- D. People are deceived about vaccine efficacy.
- E. Vaccine efficacy data is often fabricated.
- F. People are deceived about vaccine safety.
- G. The government is trying to cover up the link between vaccines and autism.

The article states that these were adopted from a study that validated them to measure vaccine conspiracy beliefs in the context of human papillomavirus vaccine acceptance, citing Shapiro et al. [2]. That source is the validation study for the Vaccine Conspiracy Beliefs Scale (VCBS), and reading it alongside the present article shows that three distinct things changed in transposition: the construct label, the context, and the scoring. To be precise about the nature of the problem: the article describes the item source and the response coding [1]. What it nowhere does is discuss or evaluate their implications as departures from the validated use, justify them, or report validity evidence for the new interpretation. The criticism throughout this commentary is of missing identification, justification and validation — not of concealment.

2.1 The construct

The VCBS was developed because, in its authors' assessment, no validated scale then existed that explicitly evaluated vaccine conspiracy beliefs [2]. The reported selection procedure was based on conspiratorial form: Shapiro et al. report retaining items from an earlier study by Jolley and Douglas [4] on the grounds that they specifically referred to a conspiracy — that is, to a deception or collusion rather than to a fear or a general attitude — and adding one further item on governmental concealment of a vaccine-autism link ([2], §2.3.4). No item-level evidential adjudication is documented, and the validation reports no assessment of the factual status of any statement.

The validation package reported by Shapiro et al. comprises the conventional components of an initial scale validation: factor structure (a one-dimensional solution), internal consistency ($\alpha = 0.937$), construct validity assessed through convergence with the

Conspiracy Mentality Questionnaire (CMQ; $r = 0.44$, with sufficient dissimilarity to justify a vaccine-specific instrument), and criterion validity through prediction of parents' willingness to vaccinate ([2], Results). The observation that matters here is narrower and does not diminish that design: none of these components adjudicates the factual accuracy of any individual proposition. The CMQ was developed by Bruder et al. to measure conspiracy mentality — a generalized tendency to engage in conspiracist ideation, which its authors treat as an individual-difference construct and support with both convergent and discriminant validity evidence against personality and generalized-attitude measures, concluding that it stands as an independent construct [3]. Two features of this evidence matter here, and both are limited in what they license. It is dispositional: the validity network concerns generalized respondent-level orientations, not the truth of any particular proposition. And it is convergent: a correlation of 0.44 identifies a related construct; it does not equate the VCBS with conspiracy mentality, nor with anything else.

What can be concluded is therefore precise and narrow. The validity evidence available for the VCBS concerns its relation to a generalized tendency toward conspiratorial ideation about vaccines [2, 3]; none of it concerns the factual accuracy of the seven propositions, item by item, and the source study nowhere claims that it does. Vaccine-conspiracy claims may well overlap with, or form a subtype of, vaccine misinformation — the two constructs are not asserted here to be disjoint. The point is narrower: the extension from the validated construct to the broader label is performed by renaming, and the inherited psychometric evidence does not by itself establish the misinformation-specific interpretation. This commentary claims that the extension is unestablished, not that the instrument demonstrably fails to measure it.

The developers of the CMQ also anticipated, in general terms, the difficulty at issue here. Discussing why they preferred a content-free instrument, Bruder et al. observe that items specifying the content of an alleged conspiracy can behave differently across contexts: where the conduct an item describes does sometimes occur, agreement may reflect appropriate skepticism and low gullibility rather than conspiracy mentality ([3], Discussion). The seven VCBS items specify alleged deceptive conduct in exactly this sense. Bruder et al.'s caution concerned transfer across contexts; it is relevant here by analogy, but does not itself establish that the misinformation interpretation fails.

2.2 The context

The seven item texts are generic vaccine-conspiracy statements rather than HPV-specific claims, so the content domain was already broad. What was HPV-specific was the validation itself: sample, criterion outcome and intended application. Validity evidence is bound to that context, and the two applications differ across multiple key dimensions. The VCBS validation data were collected in 2014 among 1,427 Canadian parents of sons aged 9–16, surveyed in English or French, with willingness to vaccinate against HPV as the criterion outcome; the validation study was published in 2016 [2]. The present study applies the items in 2021 to a Japanese general-population internet panel aged 15 and over, in Japanese translation, with COVID-19 vaccination attitudes as the outcome [1]. The vaccine, the disease, the respondent population, the language, the country and the period all differ.

Shapiro et al. anticipated precisely this and marked it as unfinished business. Among their stated future research directions is the need to examine the VCBS in other contexts — other vaccines, non-parent samples, and other countries — in order to confirm the scale’s generalizability, and they note that items measuring conspiracy beliefs prevalent in other regions might need to be included ([2], §4.2).

No validation of the Japanese-language rendering, factor analysis, internal-consistency estimate, or item-level endorsement distribution for the JACSIS sample appears in the article’s main text or in its supplementary materials [1]. Supplementary Tables S1 through S5 report the *number* of statements endorsed, cross-tabulated by age group, by covariate, and by vaccination attitude; no table reports which statements were endorsed [1]. The confirmation that the scale’s developers identified as necessary for generalization is therefore not reported anywhere in the published materials.

2.3 The scoring

A further consequential change concerns the scoring. Shapiro et al. found the VCBS to be one-dimensional — a single component with an eigenvalue of 5.10 accounting for 68.37% of total variance, item loadings between 0.84 and 0.87, and Cronbach’s alpha of 0.937 — and on that basis averaged the seven items into a single continuous score [2]. The convergent and criterion analyses in the source study were conducted on that averaged score: the correlation with conspiracy mentality, and the regression coefficients predicting willingness to vaccinate [2].

The present article does not use the average. It dichotomizes each item at “agree” or “strongly agree” on the seven-point response scale, and constructs the exposure as a count of items so endorsed [1]. Respondents are then classified by that count.

This is a modification of the scoring of a validated instrument. A continuous average and a count of items crossing a threshold are different quantities with different properties; validity evidence obtained under the former cannot be assumed to transfer sufficiently to support interpretation of the latter, and no evidence for the modified score is reported. The claim is insufficiency and uncertain transfer, not that every component of the source evidence is irrelevant.

The article reports the recoding but does not identify it as a modification of the validated scoring method, does not justify it, and does not examine its psychometric consequences.

2.4 What is missing, and whose responsibility it is

Flake and Fried define questionable measurement practices as decisions researchers make that raise doubts about the validity of the measures used in a study and ultimately about the validity of the study’s conclusions, and argue that transparency is the necessary first step, because a lack of it makes threats to construct validity impossible to evaluate at all [5]. They set out six questions whose transparent answers permit that evaluation. Four bear directly here; what follows is my grading of the article’s disclosures against each:

- **Why and how was the measure selected?** The article cites the source study [1, 2]. It does not discuss whether the existing validity evidence extends to the population,

language, outcome, or scoring at issue. *Answered descriptively; not answered substantively.*

- **What measure operationalizes the construct?** Flake and Fried list matching the measure to the construct as a reporting requirement [5]. The construct named in this article (misinformation) is not the construct for which the instrument was validated (vaccine conspiracy beliefs); whether and how the validated construct extends to the named one is not addressed. *Not answered.*
- **How was the measure quantified?** The response coding and the count are described [1] but not justified, and no psychometric properties of the resulting score are reported. *Described; not justified.*
- **Was the scale modified, and if so how and why?** The change from a continuous average to a dichotomized count is implicit in the procedural description but is never identified as a modification, justified, or evaluated. *Disclosed implicitly; not identified or justified.*

The pattern is consistent: procedures are reported, while the measurement reasoning that these questions exist to elicit is absent. Some of the underlying decisions may be defensible — dichotomization can be reasonable when a distributional or interpretive rationale is given. The point is that no rationale is given, and that the responsibility for supplying validity evidence lies with the authors who use a measure, not with readers who must otherwise infer it [5]. As Flake and Fried put it, a debate about the quality of measurement practices is not possible when the information needed to evaluate them is missing [5].

3. The items differ in evidential specificity

The item wording itself shows substantial differences in specification, and this matters because the exposure is operationalized as a count. Establishing those textual differences does not require adjudicating the truth of any item.

The differences are of degree — a continuum of specification, not two clean classes. Item G, asserting governmental concealment of a link between vaccines and autism, is the most nearly specified: the alleged link is a recognizable empirical claim that could be adjudicated against the epidemiological literature once an evidence framework and time point are fixed, though the government, the vaccine and the concealment act remain implicit. Items A and E assert that safety and efficacy data are “often fabricated” — frequency claims about a matter of fact whose adjudication would additionally turn on the indeterminate quantifier “often.”

Items B, C, D and F lie further toward the under-specified end. That immunizing children is harmful and this is covered up, that people are “deceived about vaccine efficacy” or “deceived about vaccine safety,” or that pharmaceutical companies “cover up the dangers of vaccines,” specifies neither the vaccine, the harm, the proposition misrepresented, the actor, nor the time. As written, these statements are insufficiently specified for reliable,

reproducible binary adjudication. Under some readings each expresses a proposition capable of being true or false; the defect is that the survey does not constrain which reading a respondent adopted, so no single truth evaluation can be attached to an agreement response. Agreement with them is consistent with belief in a false proposition — but also with dissatisfaction with risk communication, with the view that uncertainty was conveyed with insufficient candor, or with distrust of pharmaceutical manufacturers as commercial actors.

The ambiguity is not hypothetical. “Vaccine efficacy” may denote prevention of infection, of symptomatic disease, of onward transmission, of hospitalization, or of death. A respondent who considered that public communication had understated the distinction between any two of these endpoints could agree with item D without endorsing any specific false claim. Under the study’s coding — endorsement defined as “agree” or “strongly agree” on the seven-point scale [1] — that respondent is classified as a misinformation endorser. This commentary does not claim to know how many respondents answered in that way; the point is that the coding cannot distinguish them.

Because the exposure is a count of endorsed items, and because items differ in what agreement implies, what a given count means depends on which statements were endorsed. Two respondents with identical counts may hold substantively different belief profiles, and no analysis reported in the article or its supplementary materials distinguishes them. What this implies depends on how the count itself is read — the question taken up next.

3.1 Neither a scale reading nor an index reading supplies the missing interpretation

Two readings are considered here — not because they exhaust the logical possibilities, but because they are the most favourable interpretations available to the article, and it does not state which is intended. On a *reflective* reading, the count is an adaptation of the VCBs: the seven responses are treated as indicators of one underlying attitude, and the score inherits its meaning from the validated instrument. On a *descriptive index* reading, the count is a tally of how many of seven selected statements a respondent endorsed — analogous to a comorbidity count — and requires no unidimensionality, internal consistency, or latent continuum at all. (Nothing here turns on whether a formal formative measurement model is claimed; the index reading is taken in the ordinary sense of a composite tally.) The article cites the validated scale, which suggests the first reading, and models the count as an ordered outcome with monotone gradients in hesitancy [1], which is compatible with either.

On the reflective reading, an apparent defence is available: the items cannot be relevantly heterogeneous, because the source scale is one-dimensional with high internal consistency ($\alpha = 0.937$) [2]. The defence does not succeed. Unidimensionality is a claim about the covariance structure of responses in the validation sample, not about the propositional content of the items. A one-factor solution is compatible with several generating processes — a common concealment-oriented attitude, generalized negativity toward vaccines, conspiratorial ideation, or response style — and neither the source study nor the target article reports evidence identifying which produced the observed structure; Shapiro et

al. themselves note that pre-selecting items for conspiratorial form may have increased the likelihood of a one-dimensional result, and that the absence of reverse-coded items can inflate internal-consistency estimates independently of content ([2], §4.1). In any case, the source validation analyses were conducted on the averaged continuous score, not on the dichotomized count (Section 2.3), so even a fully reflective reading inherits no evidence for the score actually used.

On the index reading, heterogeneity and the absence of a latent continuum are not defects. The relevant validity requirements shift rather than disappear: from internal structure to component definition and score interpretation. An index means what its components are classified as, so a count of endorsed statements can be labeled “misinformation endorsement” only given a transparent and reproducible evidential basis for classifying each counted statement as misinformation; absent that, the count records breadth of endorsement across a mixed set of statements. No such classification procedure is reported, and the article’s limitations acknowledge the composition to be unresolved [1]. The index reading also raises questions the article does not answer: whether the count is intended as breadth, severity, or cumulative exposure, and what equal weighting of the seven statements is taken to mean under that intention. Equal weighting may be a deliberate definition of breadth rather than a claim of equal severity — but which it is has not been stated, and the placement of thresholds (Section 7) becomes correspondingly consequential.

Under either reading the conclusion is the same: no evidence supporting interpretation of the count specifically as misinformation endorsement is reported [1].

4. The acknowledged construct mixture is not reflected in the article’s terminology

The limitations section states that the statements the study asked about reflect a combination of acceptance of misinformation, generalized distrust, and critical skepticism toward authoritative institutions [1].

This acknowledgement concerns construct validity, not generalizability or scope — and it is not peripheral. It does not demonstrate that three separable latent constructs exist within the score; no factor model or item-level decomposition in either article establishes that. What it does establish is sufficient: by the authors’ own account, responses may combine several conceptually distinct sources — misinformation acceptance, generalized distrust, and critical skepticism — and associations estimated against the score therefore cannot, on the reported evidence, be attributed to any one of them. The adjusted odds ratios for vaccine hesitancy, including the ordered gradient from 2.12 (95% CI 1.77–2.52) for one endorsed statement to 14.99 (95% CI 11.34–19.93) for seven [1], describe relationships with a score of acknowledged mixed composition. They have not been shown to isolate misinformation.

Yet the terminology is not adjusted anywhere else in the article. Respondents are designated “misinformation endorsers” in the abstract, results, figures, discussion and

conclusion. The concession appears once, in the limitations section, and does not constrain the language used for the claims anywhere else in the article.

The single label therefore combines responses that may reflect false factual belief, generalized distrust, or critical evaluation of official communication. Because the label can imply factual error, readers may attribute the reported associations to false belief even though the article's own limitation leaves the response process unresolved.

5. The content domain is sampled in one direction, and the reference stratum is defined accordingly

Section 4 concerns what may be *included* in the score beyond misinformation. This section concerns the converse: what the instrument cannot register at all, and what follows for the group against which endorsers are compared.

All seven statements assert fabrication, deception, or concealment by governments or pharmaceutical manufacturers. Every item is oriented in the same direction. The instrument can therefore register a respondent as an endorser only for beliefs of that orientation.

The article's limitations acknowledge a scope restriction, but the acknowledgement is itself directionally confined: it notes that other widely circulated forms of misinformation, such as clinical-biological claims about vaccine harms, were not asked about, and reasons that this restricted scope may have led to underestimation of endorsement prevalence [1]. The examples given are further claims of the same orientation. The possibility that evidentially adjudicable false beliefs might also exist in the opposite direction is not addressed.

Two consequences follow, and neither requires this commentary to identify any particular statement as misinformation in either direction.

First, the label is directionally unqualified while the instrument is directionally restricted. "Misinformation endorsement," as a label, carries no orientation. The score can only be non-zero for one orientation. This is a matter of construct representation rather than of scope: an unqualified label is not supported by a measure that is constitutively unable to register one side of the domain it names. The distinction matters because the article treats its restricted scope as affecting the *magnitude* of the estimated prevalence while continuing to use the unqualified label for the *construct*.

Second, and more consequentially for the reported estimates, the reference stratum is not what its description implies. The stratified models compare respondents endorsing none of the seven statements against respondents endorsing two or more [1]. The zero-endorsement group is described throughout as individuals who did not endorse misinformation. What defines it, however, is non-endorsement of these seven statements. A respondent holding an evidentially adjudicable false belief oriented in the opposite direction would return a count of zero and enter the reference stratum. Whether and how often that occurred cannot be determined, because no such belief was measured — which

is precisely the point: the design cannot exclude it, and no analysis is available that would bear on it.

The stratified contrast is therefore between respondents endorsing two or more of these seven statements and all other respondents, not between people who do and do not hold false beliefs about vaccines. Taken together with Section 4, neither side of the contrast has been shown to isolate misinformation: the exposure stratum is of acknowledged mixed composition, and the reference stratum is defined by non-endorsement of a single-orientation item set rather than by accuracy of belief.

This commentary adjudicates no statement in either direction, and asserts nothing about what respondents in the reference stratum in fact believed. The claim concerns a property of the design and of the resulting group definitions, which can be established from the item texts and the stratification rule alone.

6. The outcome variable: the construct named and the variable measured

The exposure-side problem has a counterpart on the outcome side, and it takes the same form: a named construct that is broader than, and different in kind from, the variable actually constructed.

6.1 What was measured

The article's title, abstract and discussion refer to attitude toward COVID-19 vaccination. The outcome variable is a dichotomy: "vaccine acceptance," defined as fully or partially vaccinated *or* willing but not yet vaccinated, against "vaccine hesitancy," defined as undecided or unwilling [1]. Of the 24,403 respondents classified as accepting, 23,435 were already vaccinated — 96.0% [1].

The acceptance category is therefore, in the overwhelming majority of cases, a record of completed behavior rather than a report of a current attitude. This is not a defect in itself; uptake is a legitimate and important outcome. It becomes a problem of interpretation when the variable is named, and reasoned about, as an attitude.

6.2 Why the distinction is consequential

Behavior, intention and attitude are distinct constructs with distinct determinants, and the standard determinant frameworks in this literature specify the distinction explicitly rather than incidentally. The theory of planned behavior treats behavioral intention as jointly determined by attitude toward the behavior, subjective norm, and perceived behavioral control [7]. The 5C model of the psychological antecedents of vaccination, developed specifically for this domain, includes *constraints* — structural and practical barriers — alongside confidence, complacency, calculation and collective responsibility [8]. Under either framework, a measure of uptake or of stated willingness is not a measure of attitude, and the determinants of uptake include normative and structural components that are not attitudinal.

The explanatory variables in the present study are age, sex, educational attainment, household income, physical comorbidity, mental illness, COVID-19 infection history, and information sources [1]. No variable captures employment or student status, access to vaccination through an employer or educational institution, perceived expectation from others, or any requirement attached to occupational or social participation. The normative and structural components identified by both frameworks are entirely unmeasured.

6.3 The article invokes unmeasured determinants when interpreting its central finding

This would be a routine limitation if the article's own reasoning did not depend on the missing components.

The most striking reported result is the reversal of the age gradient across strata. Among respondents endorsing none of the statements, older age is associated with lower hesitancy (age 60–69 vs 40–49: adjusted OR 0.46, 95% CI 0.38–0.56). Among respondents endorsing two or more, respondents in their twenties show lower hesitancy instead (age 20–29 vs 40–49: adjusted OR 0.48, 95% CI 0.31–0.74), and the older-age association is not consistent [1]. The Discussion notes that this may appear counterintuitive and offers an interpretation: that the younger generation may be more flexible in determining their actions. It then adds that, although Japan did not implement vaccine mandates, easier access to vaccination through universities and workplaces, together with a strong wish to resume ordinary social life, may have attenuated the influence of endorsement on acceptance in this age group ([1], Discussion).

Both of the mechanisms named in that second sentence are non-attitudinal. Access through universities and workplaces is a structural determinant — the *constraints* component of the 5C framework [8]. A wish to resume ordinary social life operates as a determinant of vaccination only insofar as ordinary social participation was conditioned on vaccination status; as a determinant it is normative and structural, not attitudinal. The article thus explains its principal result by reference to determinants that its design neither measured nor adjusted for.

Two further features of the article point the same way. The Methods justify classifying “undecided” responses as hesitancy on the ground that vaccination had been made available to essentially all eligible citizens by the time of the survey [1]. That reasoning treats a feature of the institutional context as fixing the interpretation of a response. The same institutional context is not treated as a potential determinant of the outcome elsewhere in the analysis. Separately, the Limitations note that social desirability bias may have influenced responses, particularly for vaccination items [1]. Social desirability on a vaccination item is, by definition, an effect of perceived normative expectation on measurement. The article registers it as a caveat about response accuracy without treating the normative environment it presupposes as a determinant to be measured.

6.4 What follows

At least two interpretations are consistent with the reported divergence between endorsement and outcome.

On the first, which the article presents, endorsement does not deterministically translate into behavior, and the divergence shows that endorsement is a weaker predictor of vaccination than has sometimes been assumed.

On the second, the outcome partly records uptake under determinants the design does not measure. If so, the divergence between a respondent's endorsement and the recorded outcome is uninformative about that respondent's attitude, because the outcome is not principally a measure of attitude to begin with.

The design cannot distinguish these. Both are consistent with a cross-sectional association between an attitudinal exposure and a predominantly behavioral outcome, with the normative and structural determinants unmeasured in either case. The article presents the first and does not consider the second. Nothing in this section asserts that the second is correct, and nothing in it requires any characterization of the institutional environment in Japan in 2021. The claim is that the interpretation is underdetermined by the reported evidence, and that the determinants which would distinguish the two readings are ones the authors themselves name.

The narrowest statement of the problem is a terminological one, and it is sufficient on its own. A variable that is 96.0% completed vaccination in its positive category should not be labeled, in a title and throughout a discussion, as an attitude.

7. The classification threshold changes between analyses

Descriptive analyses classify as endorsers those agreeing with at least one of the seven statements; Figure 1B is explicit that "1–7" denotes respondents endorsing at least one statement [1]. The stratified multivariable models, however, compare respondents endorsing none against respondents endorsing two or more, as stated in the statistical analysis section, in the Figure 2 legend, and in the header of Supplementary Table S5 [1]. The public analysis code accompanying the article implements exactly this construction, subsetting the sample to counts of zero and of two or more [6].

Respondents endorsing exactly one statement are therefore excluded from the stratified analysis. The article does not explain this change.

The supplementary tables permit the exclusion to be quantified. Of the 27,943 respondents included in the hesitancy analysis, 24,868 endorsed no statement, 1,340 endorsed exactly one, and 1,735 endorsed two or more [1]. The stratified analysis therefore omits 1,340 respondents, comprising **43.6% of all 3,075 respondents who endorsed at least one statement** — that is, close to half of the group the descriptive results designate as endorsers.

The exclusion is analytically consequential and insufficiently explained, for four reasons.

First, the excluded group is not equivalent to the zero-endorsement group in the reported hesitancy model: endorsement of a single statement carries an adjusted odds ratio of 2.12 (95% CI 1.77–2.52) [1]. This bears on association with hesitancy, not on where a

classification threshold should sit — the target authors may well have sought better-separated strata — but no rationale is stated.

Second, given the item heterogeneity described in Section 3, the composition of the excluded group matters and cannot be characterized. The item-level endorsement profiles that would show which statements single-item endorsers agreed with are not reported in the main text or in any supplementary table (Section 2.2), so what the exclusion does to the comparison between strata cannot be assessed. Since respondents endorsing exactly one statement are by construction those whose count is most sensitive to which statement it was, this is the subgroup for which the missing item-level data would be most informative.

Third, the two thresholds produce different denominators, so the descriptive claim that 63.6% of endorsers accepted vaccination and the stratified regression results do not refer to the same population [1]. The two sets of results are additionally not commensurable in estimation frame: inverse probability weighting is described as applied to the calculation of prevalence and proportions, while the counts underlying the regression tables are unweighted [1].

Fourth, a prior question underlies both thresholds. The instrument as validated has no threshold at all: the seven items were averaged into a continuous score, and the source study's convergent and criterion analyses were conducted on that average [2]. Once a continuous measure is converted into a count of items crossing a cut-point, the location of the cut becomes an analyst-selected operational decision requiring justification. The article makes that decision twice, differently, without stating a rule or reporting sensitivity analyses. The two thresholds may serve different purposes — descriptive prevalence of any endorsement, versus construction of well-separated strata — but no purpose is stated, and a rationale that is not given cannot be evaluated. The unexplained change in operational definition across analyses is therefore a visible symptom of the unidentified scoring modification described in Section 2.3, rather than an isolated reporting lapse.

8. Cross-stratum comparisons are asserted rather than tested

The Results describe television and internet/social-media associations as stronger among endorsers and the government-information association as present only among non-endorsers, and the Conclusion builds a communication recommendation on these contrasts [1]. These are cross-stratum claims, but separate significance or separate coefficient estimates do not test whether coefficients differ. The article reports no interaction test, and the inspected script fits separate additive logistic models without an interaction term [1, 6]. The contrasts should therefore be described as untested unless an interaction estimate on the authors' chosen scale is reported.

Inspection of the separately reported intervals is not a substitute, and is not offered as one here. Overlapping confidence intervals do not establish the absence of a difference, and non-overlapping intervals are at best a conservative indication of one; that asymmetry is exactly why an interaction estimate is required rather than optional. The observation worth recording is narrower: for three of the four contrasts on which the Conclusion rests, the

separately reported intervals overlap, so the difference is not self-evident from the reported quantities. Comparing the zero-endorsement and two-or-more strata in Supplementary Table S5 [1]:

Information source	Zero endorsement, adjusted OR (95% CI)	Two or more, adjusted OR (95% CI)	Intervals
Government	0.69 (0.61–0.78)	0.98 (0.73–1.32)	overlap
Television	0.56 (0.49–0.65)	0.38 (0.28–0.52)	overlap
Newspaper	0.77 (0.67–0.87)	0.59 (0.44–0.79)	overlap
Internet / social media	1.25 (1.10–1.43)	2.97 (2.14–4.14)	no overlap

The untested status is therefore not a formality. The television and newspaper contrasts are the ones on which the recommendation in Section 9 principally rests, and for both of them the reported intervals overlap.

9. Consequences for the policy recommendation

The conclusion recommends that public institutions strategically use traditional media to disseminate vaccine messages, on the grounds that reliance on internet and social media was more strongly associated with hesitancy among endorsers while television and newspapers were associated with greater acceptance in this group [1].

Four inferential steps separate the data from this recommendation. None of the stratum contrasts is formally tested, and for the two contrasts most directly supporting the recommendation the reported intervals overlap (Section 8). The stratifying variable has not been demonstrated to isolate misinformation from generalized distrust and critical skepticism, and the reference stratum is not defined by absence of false belief (Sections 4 and 5). The outcome is predominantly a record of completed vaccination rather than of attitude, so an association with it does not straightforwardly identify what a message would change (Section 6). And cross-sectional associations between self-reported information sources and attitudes do not identify the effect of message placement; the authors' own limitations section notes that the relationships may be bidirectional, with pre-existing distrust shaping information seeking [1].

If a substantial share of the endorser stratum consists of respondents who distrust official communication, the data do not establish that routing official communication through channels correlated with acceptance in that stratum would increase acceptance, and they do not identify the operative mechanism.

10. Implications for future measurement

Measurement claims should distinguish item-level classification from respondent-level interpretation. A statement should be coded as misinformation only under an explicit evidence base, time point, and adjudication rule; ambiguous allegations of deception do not support a unique truth classification. When a scale is relabeled or rescored, the new interpretation requires its own justification, and item-level results should be reported when a composite count obscures which statements drive an association.

Two further requirements follow from Sections 5 and 6. Where a construct label is unqualified as to direction, the item set should sample the domain in both directions, or the label should be qualified to match the item set; and the composition of the reference group deserves the same explicit statement as the composition of the exposure group, since a contrast is only as interpretable as both of its sides. Where the outcome is uptake or intention rather than attitude, it should be named as such, and the normative and structural determinants specified by standard frameworks should either be measured or identified as unmeasured confounders — particularly where they are invoked in interpreting the results.

11. Conclusion

Furuse and Tabuchi provide useful evidence that vaccination behavior cannot be read off distrustful attitudes [1]. Their exposure estimates should be interpreted as associations with endorsement of two or more of seven statements concerning fabrication, deception and concealment — scored through a dichotomized count of statements drawn from a scale validated for a narrower, differently defined construct in a different context, and compared against a reference group defined by non-endorsement of that same single-orientation item set. No content-classification procedure or construct-specific validity evidence supporting a misinformation interpretation is reported [1, 2]. The associations have not been shown to be associations with misinformation endorsement under the evidential criterion stated in the Introduction, and the article's terminology asserts more than its reported evidence supports.

The same gap between named construct and measured variable recurs on the outcome side. A variable whose positive category is 96.0% completed vaccination is described as an attitude, and the determinants that standard frameworks identify as governing uptake but not attitude are unmeasured — including the two the authors themselves invoke when interpreting their central result. The reported divergence between endorsement and outcome is accordingly consistent with more than one reading, and the article presents one.

Whether these problems materially alter the substantive findings requires further analyses and a response from the original authors. The present purpose is to establish that the current interpretation is contestable and that these methodological objections have been formally documented.

Appendix A. Discrepancies observed within the supplementary tables

The following were noted in the course of auditing the supplementary materials for Section 2.2. They are recorded because the supplementary tables are the only published source for the values underlying Figures 1 and 2, and because a reader auditing those tables will encounter them.

They are stated as observations only. They may originate in table preparation rather than in the underlying analysis, and this commentary draws no inference as to which, nor does any argument elsewhere in this commentary depend on them. Each is internally checkable against the published table.

1. **Supplementary Table S5, sex row.** In the zero-endorsement stratum, the adjusted odds ratio for female sex is reported as 1.01 (95% CI 0.91–1.13) with $P < 0.0001$, and both entries are set in bold. In the two-or-more stratum, the same variable is reported as 1.30 (95% CI 1.01–1.67) with $P = 0.91$, not in bold. An interval containing 1 is not consistent with $P < 0.0001$, and an interval excluding 1 is not consistent with $P = 0.91$; the two P -values are consistent with each other's estimates if exchanged. Under the table's stated convention, in which bold denotes $P < 0.05$, the bolding follows the P -values rather than the intervals. This occurs in the table that supplies the values underlying Figure 2.
2. **Supplementary Table S3, age 70 and over.** The unadjusted odds ratio for vaccine hesitancy is reported as 0.35 (95% CI 0.30–0.40) with $P = 0.37$, and neither entry is set in bold. The interval excludes 1. The corresponding adjusted estimate, 0.40 (95% CI 0.33–0.49) with $P < 0.0001$, is set in bold, as are the unadjusted estimates for the adjacent age strata.
3. **Supplementary Table S4, age 70 and over, undecided versus acceptance.** The unadjusted odds ratio is reported as 0.44 with 95% CI 0.21–0.33. The point estimate lies outside its own reported interval, and it duplicates the point estimate reported in the adjacent unwilling-versus-acceptance column for the same stratum, 0.44 (95% CI 0.36–0.53). The corresponding adjusted estimate is 0.27 (95% CI 0.21–0.36).
4. **Supplementary Table S4, mental illness, undecided versus acceptance.** The unadjusted estimate 1.18 (95% CI 0.99–1.42), $P = 0.070$, is set in bold, while the adjusted estimate in the same row, 1.03 (95% CI 0.81–1.31), $P = 0.82$, is not. The table states that bold denotes $P < 0.05$, so the bolding is applied here as a significance marking to an estimate that does not meet the stated criterion.

Items 1, 2 and 4 were verified at cell level against the document markup of the published supplementary file, including character formatting, to exclude the possibility that they arise from text extraction rather than from the source.

Clarification or correction of these entries would be useful independently of the arguments in this commentary.

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Competing interests

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Use of AI tools

Large language models were used for drafting assistance, adversarial review simulation, and language editing. The cited passages and numerical values used in this commentary were checked by the author against the materials specified in the following statement. The author takes full responsibility for the content.

Data and materials

No new data were generated. This commentary analyzes the published main text of the commented article (open access under CC BY 4.0), its supplementary materials, and the full texts of the sources listed in the references; characterizations of those sources were checked against the originals. The public analysis code cited in the article's data availability statement was examined and is cited as reference [6].

In Version 2.0 the supplementary materials accompanying the commented article (Supplementary Tables S1–S5 and Supplementary Figure S1) were examined directly. The scope condition stated in Version 1.0 — that the supplementary tables had not been independently audited — is accordingly withdrawn. Statements in this commentary that an analysis or item of evidence is not reported are scoped to the article's main text, its supplementary materials, and the inspected script.

The file audited was the supplementary material distributed with the article (supplementary_file_1.docx), SHA-256 d7aa49e3948e98590a480168b37d48e837a66f29049ec57a0fc25afe1eb695cb, retrieved August 5, 2026. Tabulated values were read from the document markup cell by cell, including character formatting, rather than from a converted rendering, in order to exclude transcription artifacts. The counts reported in Section 7 were derived arithmetically from the endorsement rows of Supplementary Table S3 and cross-checked independently against the stratum totals of Supplementary Table S5; the odds ratios and intervals reported in Section 8 were read from Supplementary Table S5.

Recommended citation

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