

# Psychometric Analysis of the National Household Survey on Disaster Preparedness Affinity

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Natural disasters pose significant risks to physical and mental health as well as financial stability. Household-level preparedness can be life-saving, yet there is limited psychometric analysis of tools measuring disaster preparedness affinity. This study analyzes the psychometric properties of the 2023 National Household Survey (NHS), conducted by FEMA, which includes items designed to measure preparedness affinity. Key findings indicate good reliability and criterion validity, but limited construct validity. Exploratory factor analysis supports a single-factor model representing preparedness affinity. Further refinement of the scale is recommended to improve its psychometric robustness. Disclaimer: FEMA and the Federal Government cannot vouch for the data or analyses derived from these data after the data have been retrieved from the Agency's website.

## Introduction

The United Nations Office for Disaster Risk Reduction defines disasters as a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts (United Nations Office for Disaster Risk Reduction (UNDRR) 2024). Notably, as global climate change progresses, it will increase the probability of extreme and hazardous weather events (Keim 2008). Quantifying this increase could help underscore the urgency of mitigation and adaptation strategies. A critical component of mitigating the human, material, and economic cost of disasters is increasing government, community, and individual preparedness. In fact, the federal government estimates that for every dollar spent on pre-disaster mitigation and preparedness efforts can prevent up to six dollars in losses from

potential disasters (Council 2018). As such, understanding the degree of individual preparedness is essential, as it can help government and non-government organizations design and target programs to improve it.

The Federal Emergency Management Agency (FEMA) has conducted an annual National Household Survey (NHS) to measure household disaster preparedness actions and attitudes since 2013. The results from this survey are used by FEMA as well as state and local emergency response agencies and non-government organizations to monitor the expected resilience of the nation, and to better understand what drives preparedness at the individual household level. In the public release of the 2023 results from the survey four concepts, made up of 7 of the items included in the survey, were identified as contributing to disaster preparedness affinity: awareness of information, disaster experience, preparedness efficacy, and disaster risk perception (Federal Emergency Management Agency (FEMA) 2023). These items have not been formally defined as a scale to measure individual preparedness affinity, but it is worth exploring the psychometric qualities of them as a scale due to the scale and resources behind the larger survey they are delivered in.

This study aims to assess the internal consistency and reliability of these NHS items related to disaster preparedness affinity, evaluate the criterion validity of these items based on self-reported preparedness actions, assess construct validity using economic and household demographic data, and explore the latent structure of the preparedness affinity construct using exploratory factor analysis.

## Methods

The 2023 NHS was a cross-sectional survey that targeted adults aged 18 and older who were U.S. residents, with a total of 7,604 complete responses. It was distributed online via invite, and was

administered confidentially. Populations at higher risk for specific hazards (7%, n=525) and underrepresented groups, including American Indian, Alaska Native, Native Hawaiian, and Pacific Islanders (7%, n=517) were over-sampled. Additional demographic characteristics such as age, gender, race, ethnicity, and income were monitored while the survey was live and compared to soft quotas which were created using U.S. Census Bureau data from the 2021 Five-Year American Community Survey and the 2020 Decennial Census of Island Area. Seven percent (n=525) of participants completed the survey in Spanish, all other participants completed the survey in English. All responses included in this analysis were complete; however, some demographic variables were imputed by FEMA, including education, gender, race, disability, home-ownership, income and ethnicity. Across all of these variables, the average change from imputation was 0.51%. Further details on the sample demographics can be found in Table 1.

Preparedness affinity was measured using a subset of items from the NHS, which were identified by FEMA as being relevant driving factors of this construct. The specific items can be found in Table 2. The items each had a custom set of response options, none following a standard Likert-scale format. Ordinal response values were sorted and converted into numeric values. The number of preparedness resources encountered was also included in the scale as a count. The sum of all of the items was used as the final numeric scale.

Internal consistency reliability was measured using Cronbach's alpha. Criterion validity was assessed by measuring the pair-wise correlation between the preparedness affinity scale with self-reported preparedness actions (a strong behavioral indicator), and construct validity through pair-wise correlations with demographic variables such as income, disability status, household size, home-ownership, age, and rural status. Exploratory Factor Analysis using Principal Axis Factoring was used to assess the latent structure. Principal Axis Factoring was selected over Principal Component Analysis because for this particular application the objective was to assess the validity

of FEMAs claim that the four driving factors of preparedness are awareness of information, disaster experience, preparedness efficacy, and disaster risk perception. A scree plot was used to guide the selection of a one factor model. However, because the study was interested specifically in measuring the validity of the four factor model that was identified, two- and four-factor models were also generated. Before any factor analysis was conducted, tests were completed to ensure factor analysis was appropriate. First, Bartlett's test was applied to ensure the correlation matrix was significantly different from an identity matrix. The p-value for this test was much smaller than 0.05, allowing for rejection the null hypothesis of Bartlett's test, indicating that there are significant relationships among the variables. Next, the Kaiser-Meyer-Olkin test was applied to measure the adequacy of the sample for factor analysis by quantifying the proportion of variance among your variables that might be common variance. The overall KMO value was 0.84, indicating excellent factor adequacy, and that a factor analysis is appropriate for this sample. Due to the correlations that existed between items, an oblique rotation was applied to the data prior to factoring. Principal Axis Factoring was then applied using all three potential factor structures for completeness. Cronbach's alpha was calculated for each of the component factors in the two- and four-factor models.

## Results

The preparedness affinity scale demonstrated good internal consistency reliability with a Cronbach's alpha of 0.75. However, the considerable difference between the standardized (0.81) and unstandardized alpha values suggests a difference in variation across items, which is likely a result of the different response sets available (see Table 3). Additionally, it was found that the raw alpha value would increase to 0.79 if the item counting the number of sources participants encountered that build awareness of preparedness resources (see Table 4).

Preparedness affinity demonstrated a moderately strong correlation ( $r = 0.67$ ) with the total number of preparedness actions taken, providing evidence for good criterion validity. It was hypothesized that disability status, caretaker status, the number of children and adults in a household, home-ownership status, income, rurality, and age might have convergent relationships with preparedness affinity and support construct validity. However, no substantial evidence of convergent construct validity was found, as correlations with demographic variables were negligible ( $r < 0.2$ ), suggesting limited alignment with external constructs (see Table 5). There were no reasonable candidates to assess divergent validity in the dataset.

An initial scree plot (see Figure 1) indicated that only a one factor model would be appropriate according to the Kaiser-Guttman rule. However, there were large drops in the eigen values after two and four factors. While these drops do not necessarily suggest valid factor structures, they were of interest because of the hypothesized factor structure. Exploratory Factor Analysis indicated that a single-factor model explained 36% of the variance with strong factor loadings across all items (see Table 6). A two-factor model explained 43% of the variance with reduced complexity and was interpreted as “Disaster Awareness” and “Risk Perception” with Cronbach’s alphas of 0.67 and 0.68, respectively (see Table 7). As expected, the four-factor model failed to produce distinct factors with overlapping loadings (see Table 8). The factors that it did identify, however, were perceived self preparedness ( $\alpha = 0.76$ ), preparedness efficacy ( $\alpha = 0.69$ ), disaster awareness ( $\alpha = 0.46$ ), and risk perception ( $\alpha = 0.46$ ). These only somewhat aligned with the hypothesized factors.

## Discussion

The NHS preparedness affinity items demonstrated strong reliability and acceptable criterion validity but lacked robust construct validity. The preparedness affinity scale’s internal consistency, as

indicated by a Cronbach's alpha of 0.75 (standardized alpha = 0.81), reflects a degree of coherence among the items despite their differing response formats. This finding supports the potential utility of the NHS items for assessing preparedness affinity. The moderately strong correlation ( $r = 0.67$ ) between preparedness affinity and self-reported preparedness actions further substantiates the scale's criterion validity, emphasizing its alignment with behavioral indicators of preparedness.

However, the scale showed negligible correlations with key demographic variables hypothesized to converge with preparedness affinity, including income, rurality, and disability status. These results suggest limited construct validity, potentially due to the preparedness affinity construct not aligning well with broader sociodemographic factors or the items failing to fully capture the multidimensional nature of preparedness. Possible reasons for these limitations include the inherent complexity of preparedness behaviors, cultural or contextual variability in disaster risk perception, and the diversity of factors influencing preparedness that may not be adequately represented in the current items. Addressing these issues in future research could involve expanding the item pool to capture a broader range of preparedness dimensions or incorporating qualitative methods to better understand underlying constructs. This issue is compounded by the lack of evidence for divergent validity, leaving the boundaries of the construct underexplored.

Factor analysis revealed that the preparedness affinity construct may be best represented as a unidimensional scale, as a single-factor model explained 36% of the variance with strong loadings across all items. Although a two-factor model (interpreted as "Disaster Awareness" and "Risk Perception") explained a slightly greater proportion of variance (43%), its reliability was lower, with Cronbach's alphas of 0.67 and 0.68, respectively. The four-factor model, corresponding to FEMA's hypothesized structure, failed to yield distinct or reliable factors, with overlapping loadings and Cronbach's alphas as low as 0.46. These findings challenge the validity of FEMA's conceptual framework and suggest redundancy among the hypothesized components.

Despite the limited evidence for construct validity and complex factor structure, the selected NHS items offer a promising foundation for assessing preparedness affinity, particularly given the comprehensive and representative sampling strategy employed in the survey. The inclusion of high-risk and underrepresented populations enhances the generalizability of the findings and underscores the scale's potential utility in diverse contexts.

## Limitations

This study faced several limitations. The cross-sectional design of the NHS precluded the assessment of test-retest reliability, limiting insights into the stability of the preparedness affinity scale over time. Construct validity analysis was constrained by the available demographic variables, many of which exhibited negligible correlations with the scale. Additionally, inconsistent response formats across items likely introduced variability in item-level responses, contributing to the observed discrepancy between standardized and unstandardized alpha values. For example, some items used binary response options (e.g., “Yes” or “No”), while others employed ordinal scales with varying numbers of categories. Such discrepancies may have also affected participants’ interpretation and response tendencies, undermining the overall coherence of the scale. This issue underscores the need for more uniform response sets to enhance scale coherence. Furthermore, the scale’s reliance on self-reported data may introduce social desirability bias, potentially inflating associations with preparedness actions. While there were quotas met on racial, ethnic, and hazard risk diversity within the US, there is evidence to suggest that disaster risk perception - a substantial component of this scale - is culturally dependent (Gierlach, Belsher, and Beutler 2010). Therefore, it would be inappropriate to use it outside of the United States without further adjustment and study.

Finally, the factor analysis results highlight the need for additional evidence to support the dimen-

sionality of the preparedness affinity construct. While the one- and two-factor models offer some interpretive value, the four-factor model's poor performance raises concerns about the validity of the hypothesized structure. This poor performance suggests significant redundancy and overlap among the hypothesized factors, which undermines their distinction and reliability. Such findings challenge FEMA's conceptual framework by indicating that the proposed components may not reflect separate dimensions of preparedness affinity as intended. This misalignment raises critical questions about the theoretical assumptions guiding the model and highlights the need for reevaluating its foundational constructs. Future research should incorporate alternative factor structures and validation techniques to refine the scale.

## Conclusion

The 2023 NHS provides a promising foundation for measuring disaster preparedness affinity, offering strong reliability and acceptable criterion validity. However, the scale's limited construct validity and inconsistent response formats highlight the need for further refinement. Future research should focus on developing a more comprehensive model of preparedness affinity, incorporating additional measures to establish convergent and divergent validity. Longitudinal studies are essential to evaluate test-retest reliability, while uniform response formats could enhance scale coherence. With these advancements, the NHS preparedness affinity scale could become a robust tool for assessing and promoting disaster preparedness at the individual and community levels.



Figure 1: Scree Plot

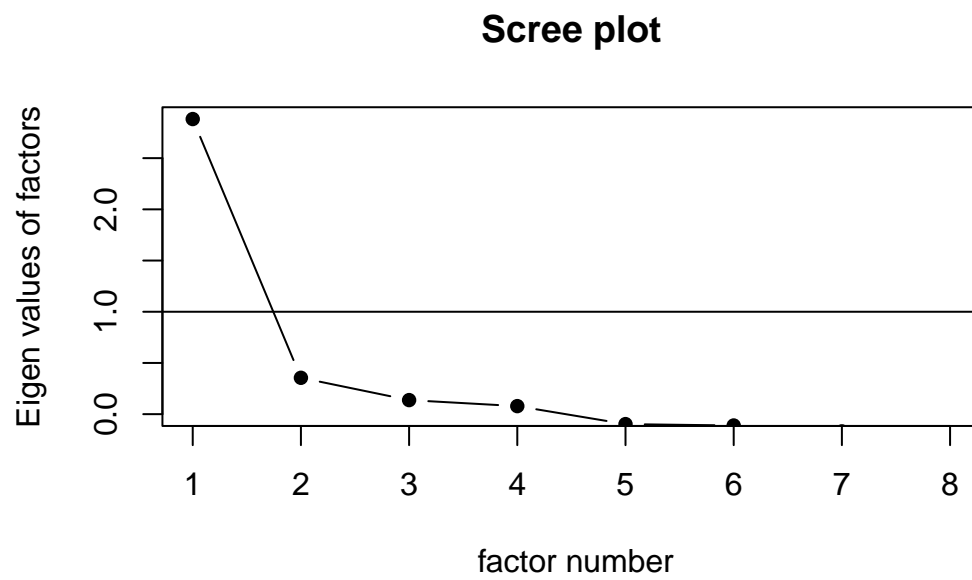


Table 1: Survey Sample

	Overall
	(N=7604)
Age	
18-19	239 (3.1%)
20-29	1296 (17.0%)
30-39	1595 (21.0%)
40-49	1102 (14.5%)
50-59	1139 (15.0%)
60-69	1093 (14.4%)
70-79	809 (10.6%)
80+	331 (4.4%)
Sex	
Female	3918 (51.5%)
Male	3631 (47.8%)
Third-Gender/Other	55 (0.7%)
Race	
White	5050 (66.4%)
Black or African American	981 (12.9%)
Two or More Races	408 (5.4%)
Other	360 (4.7%)
American Indian or Alaska Native	345 (4.5%)
Asian	338 (4.4%)
Native Hawaiian or Other Pacific Islander	122 (1.6%)
Homeownership	
Own	4626 (60.8%)
Rent	2978 (39.2%)
Income	
\$100K +	1696 (22.3%)
\$50,000 to \$99,999	2364 (31.1%)
Less than \$50k	3544 (46.6%)
Disability	
No Disability	5749 (75.6%)
Disability	1855 (24.4%)

Table 2: Preparedness Affinity Items

Variable	Survey Item Text or Description
dis_prep	Have you considered preparing for a disaster?
dis_soc	Thinking about preparing yourself for a disaster, which of the following best represents your degree of preparedness?
dis_awareness_a-dis_awareness_n	In the past year, what information have you read, seen, or heard about how to get better prepared for a disaster?
dis_awareness_effect	#If any option other than “None of the above” or “Don’t know” is selected from dis_awareness# After receiving the information about how to get better prepared, did you take any steps to prepare for a disaster?
dis_perception	Thinking about the area you live in, how likely would it be for a disaster to impact you?
dis_stepshelp	How much would taking steps to prepare help you get through a disaster in your area?
dis_confidence	How confident are you that you can take steps to prepare for a disaster in your area?
dis_exp	Have you or your family ever experienced the impacts of a disaster?

Table 3: Unstandardized and Standardized Cronbach’s Alpha

Raw Alpha	Std. Alpha	Median R
0.754	0.813	0.339

Table 4: Cronbach’s Alpha Item Details

Item	Raw Alpha	Std. Alpha	Alpha SE
Disaster Prep	0.710	0.784	0.004
Disaster Soc	0.702	0.780	0.005
Disaster Exp	0.751	0.810	0.004
Disaster Perception	0.741	0.802	0.004
Disaster Stepshelp	0.717	0.785	0.004
Disaster Confidence	0.719	0.788	0.004
Disaster Awareness Effect	0.710	0.780	0.005
Disaster Awareness Count	0.795	0.799	0.003

Table 5: Criterion and Construct Validity

Type	Item	r	P.Value	Pass
Criterion	Dis Prepaactions Count	0.672	0.000	TRUE
Convergent	Disability	-0.005	0.636	FALSE
Convergent	Care	0.105	0.000	FALSE
Convergent	Numchild	0.139	0.000	FALSE
Convergent	Numadult	0.065	0.000	FALSE
Convergent	Homeownership	0.112	0.000	FALSE
Convergent	Income Agg	0.165	0.000	FALSE
Convergent	Rurality	-0.016	0.175	FALSE
Convergent	Age	-0.093	0.000	FALSE

Table 6: Factor Loadings of 1 Factor PAF

	Preparedness Affinity
Disaster Prep	0.660
Disaster Soc	0.694
Disaster Exp	0.436
Disaster Perception	0.492
Disaster Stepshelp	0.631
Disaster Confidence	0.620
Disaster Awareness Effect	0.681
Disaster Awareness Count	0.535

Table 7: Factor Loadings of 2 Factor PAF

	Disaster Awareness	Risk Perception
Disaster Prep	0.781	-0.037
Disaster Soc	0.791	-0.010
Disaster Exp	0.117	0.361
Disaster Perception	-0.014	0.567
Disaster Stepshelp	-0.037	0.769
Disaster Confidence	0.110	0.582
Disaster Awareness Effect	0.482	0.252
Disaster Awareness Count	0.388	0.189

Table 8: Factor Loadings of 4 Factor PAF

	Percieved Prepared- ness	Prepared- ness Efficacy	Disaster Awareness	Risk Perception
Disaster Prep	0.565	0.018	0.154	0.062
Disaster Soc	0.921	0.011	-0.024	-0.004
Disaster Exp	0.095	-0.042	0.052	0.451
Disaster Perception	-0.026	0.027	-0.022	0.689
Disaster Stepshelp	-0.054	0.785	0.011	0.028
Disaster Confidence	0.108	0.650	-0.005	-0.030
Disaster Awareness Effect	0.198	0.069	0.451	0.119
Disaster Awareness Count	-0.026	0.010	0.757	-0.016

## Code

The code used to perform the analysis above was done in four chunks: data wrangling, reliability analysis, validity analysis, and factor analysis. The code can also be found in this Github repository:

[<https://github.com/jamann246/pyschometrics-final>].

## Data Wrangling

```
# this file is for the ingest and wrangling of the data needed

# for the analysis of psychometric properties of the nhs survey


# load the full dataset
nhs_raw <- readxl::read_excel(

  path = "./fema_national_household_survey_2023/fema_national_household_survey_2023_data_and_codeb

  sheet = "Core Survey",

  skip = 1

) |>

# dplyr::filter(sample == "National") |>

dplyr::select(

  # scale

  dis_prep,

  dis_soc,

  dis_exp, # experience

  dis_perception, # risk perception

  dis_stepshelp, # efficacy
```

```

dis_confidence, # efficacy

dplyr::starts_with('dis_awareness'), # awareness


# criterion

dplyr::starts_with("dis_preactions"),


# content

disability, care, numadult, numchild, age,

homeownership, income_agg, rurality,


# other sample stuff

primarylanguage, sex, education, ethnicity, race_selfid

) |>

dplyr::mutate(

  dplyr::across(

    dplyr::everything(),

    ~dplyr::if_else(.x == "Blank", NA, .x)

  )

)

write.csv(nhs_raw, "nhs-raw.csv")


# convert the scale data to numeric

```

```

nhs <- nhs_raw |>
  dplyr::mutate(
    dis_prep =
      factor(
        dis_prep,
        levels = c(
          "Don't know",
          "No",
          "Maybe",
          "Yes",
          "Yes, and I have taken steps to prepare",
          "Yes, and preparedness is part of my everyday life"
        ),
        ordered = TRUE
      ),
    dis_exp =
      factor(
        dis_exp,
        levels = c("Don't know", "No", "Yes"),
        ordered = TRUE
      ),
    dis_soc =
      factor(
        dis_soc,

```



```

levels = c(
  "Don't know",
  "I am NOT prepared, and I do not intend to prepare in the next year",
  "I am NOT prepared, but I intend to start preparing in the next year",
  "I am NOT prepared, but I intend to get prepared in the next six months",
  "I have been prepared for LESS than a year",
  "I have been prepared for MORE than a year and I continue preparing"
),
ordered = TRUE
),
dis_perception =
factor(
  dis_perception,
  levels = c(
    "Don't know",
    "Unlikely",
    "Likely",
    "Very likely"
  ) ,
  ordered = TRUE
),
dis_stepshelp =
factor(
  dis_stepshelp,

```

```

levels = c(
  "Don't know",
  "Not at all",
  "Very little",
  "Somewhat",
  "Quite a bit",
  "A great deal"
),
ordered = TRUE
),
dis_confidence =
factor(
  dis_confidence,
  levels = c(
    "Don't know",
    "Not at all confident",
    "Slightly confident",
    "Somewhat confident",
    "Moderately confident",
    "Extremely confident"
  ),
  ordered = TRUE
),
dis_awareness_effect =

```

```

factor(
  dis_awareness_effect,
  levels = c(
    "Don't know",
    "No",
    "Yes"
  ),
  ordered = TRUE
),
dis_awareness_count = rowSums(
  !is.na(
    nhs_raw[, c(
      'dis_awareness_a', 'dis_awareness_b', 'dis_awareness_c', 'dis_awareness_d',
      'dis_awareness_e', 'dis_awareness_f', 'dis_awareness_g', 'dis_awareness_h',
      'dis_awareness_i', 'dis_awareness_j', 'dis_awareness_k', 'dis_awareness_l',
      'dis_awareness_m', 'dis_awareness_n'
    )]
  )
),
dis_prepactions_count = rowSums(
  !is.na(
    nhs_raw[, c(
      "dis_prepactions_a", "dis_prepactions_b", "dis_prepactions_c", "dis_prepactions_d",
      "dis_prepactions_e", "dis_prepactions_f", "dis_prepactions_g", "dis_prepactions_h",

```

```

      "dis_prepactions_i", "dis_prepactions_j", "dis_prepactions_k", "dis_prepactions_l",
      "dis_prepactions_m", "dis_prepactions_n"
    )
  )
),
disability = dplyr::if_else(
  disability == "Disability",
  1, 0
),
care = dplyr::if_else(
  care == "Yes",
  1, 0
),
homeownership = dplyr::if_else(
  homeownership == "Own",
  1, 0
),
income_agg = factor(
  income_agg,
  levels = c("Less than $50k", "$50,000 to $99,999", "$100K +")
),
rurality = dplyr::if_else(
  rurality == "Rural",
  1, 0

```

```

),

age = substr(age, 1,1)

) |>

dplyr::select(

  dis_prep, dis_soc, dis_exp, dis_perception, dis_stepshelp,

  dis_confidence, dis_awareness_effect, dis_awareness_count,

  dis_prepactions_count,

  disability, care, numchild, numadult, homeownership,

  income_agg, rurality, age

) |>

dplyr::mutate(

  dplyr::across(dplyr::everything(), as.numeric),

  dis_awareness_effect = dplyr::if_else(is.na(dis_awareness_effect), 0, dis_awareness_effect)

)

# storing the wrangled dataset

write.csv(nhs, "nhs-clean.csv")

```

## Reliability Analysis

```

# this file is being used to conduct a reliability analysis of the target scale

# loading data

scale <- read.csv("nhs-clean.csv") |>

```

```

dplyr::select(
  dis_prep,
  dis_soc,
  dis_exp,
  dis_perception,
  dis_stepshelp,
  dis_confidence,
  dis_awareness_effect,
  dis_awareness_count
)

# calculating cronbach's alpha
alpha_results <- psych::alpha(
  as.data.frame(scale),
  check.keys = TRUE,
  max = 100
)

alpha_results

readr::write_rds(alpha_results, file = "alpha-results.rds")

```

## Validity Analysis

```
# this file will conduct checks for criterion and content validity of the scale

# loading data

nhs <- read.csv("nhs-clean.csv") |>

dplyr::mutate(

  preparedness_affinity =

    dis_prep +

    dis_soc +

    dis_exp +

    dis_perception +

    dis_stepshelp +

    dis_confidence +

    dis_awareness_effect +

    dis_awareness_count

) |>

dplyr::select(

  -c(X,

    dis_prep,

    dis_soc,

    dis_exp,

    dis_perception,

    dis_stepshelp,
```

```

    dis_confidence,

    dis_awareness_effect,

    dis_awareness_count

  )

)

# looking at everything at once

corrplot::corrplot(cor(nhs))

cor(nhs)[,c('preparedness_affinity')]

# criterion validity

# looking at concurrent validity

criterion_test <- cor.test(nhs$preparedness_affinity, nhs$dis_preactions_count)

criterion_validity = tibble::tibble(

  Type = "Criterion",

  Variable = "dis_preactions_count",

  r = round(criterion_test$estimate, digits = 3),

  `P-Value` = round(criterion_test$p.value, digits = 3),

  Pass = ifelse(r >= 0.06, TRUE, FALSE)

)

# construct validity

# expected correlated variables (convergent)

```



```

# dis_prep: Have you considered preparing for a disaster?

# dis_soc: Thinking about preparing yourself for a disaster, which of the following best represents your degree of
# disability: Do you have a disability or a health condition that might affect your capacity to respond to an emergency?
# care: Do you currently live with or have primary responsibility for assisting an elderly person or someone with a disability?
# numadult: Including yourself, how many adults live in your household?
# numchild: How many household members are children under the age of 18?
# homeownership: Do you rent or own your home? (includes imputed values)
# income_agg: Calculated field - Which of the following describes your total household ANNUAL income before taxes and
# rurality: Calculated field - rurality designation based on ZIP code, county, and state
# age: what is your age (categories)

```

```

convergent_variables <- colnames(nhs)[2:9]

```

```

convergent_validity <- purrr::map_df(
  convergent_variables,
  \(i){
    test <- cor.test(nhs$preparedness_affinity, nhs[,i])
    tibble::tibble(
      Type = "Convergent",
      Variable = i,
      r = round(test$estimate, digits = 3),
      `P-Value` = round(test$p.value, digits = 3),
      `Pass` = ifelse(test$estimate >= 0.4 & test$estimate <= 0.5, TRUE, FALSE)
    )
  }
)

```

```

}
)

validity <- dplyr::bind_rows(criterion_validity, convergent_validity)

write.csv(validity, "validity-results.csv")

```

## Factor Analysis

```

# this script will be used to conduct exploratory factor analysis

# I will pay some attention to a potential four factor model to see if it might align with the findings generated b

# load data

nhs <- read.csv("nhs-clean.csv") |>

dplyr::select(

  dis_prep,

  dis_soc,

  dis_exp,

  dis_perception,

  dis_stepshelp,

  dis_confidence,

  dis_awareness_effect,

  dis_awareness_count

)

```

```

# checking that the correlations are large enough to analyze

# p value should be less than 0.05

bartlett_result <- psych::cortest.bartlett(cor(nhs))

bartlett_result # passed


# checking that the sample is sufficient

# overall MSA should be greater than 0.5, all item wise MSA should be greater than 0.5

kmo_result <- psych::KMO(cor(nhs))

kmo_result # passed, very good

# all variables are > 0.5, we don't need to evaluate anything for exclusion


# checking the determinate to assess potential multicollinearity

# looking for greater than 0.00001

det(cor(nhs)) # passed


# scree plot

psych::scree(cor(nhs), pc=FALSE)


# Principal Axis Factoring


# Testing a single factor model per the scree plot

# using an oblique rotation (items and factors are correlated)

```

```

single_factor <- psych::fa(nhs, nfactors = 1, fm = "pa", rotate = "oblimin", max.iter = 1000)

# Summary of the results

single_factor

# PA1  h2  u2 com

# dis_prep      0.66 0.44 0.56  1
# dis_soc       0.69 0.48 0.52  1
# dis_exp       0.44 0.19 0.81  1
# dis_perception 0.49 0.24 0.76  1
# dis_stepshelp 0.63 0.40 0.60  1
# dis_confidence 0.62 0.38 0.62  1
# dis_awareness_effect 0.68 0.46 0.54  1
# dis_awareness_count 0.53 0.29 0.71  1

#          PA1

# SS loadings  2.88

# Proportion Var 0.36

# testing a 2 factor model

two_factor <- psych::fa(nhs, nfactors = 2, fm = "pa", rotate = "oblimin", max.iter = 1000)

# Summary of the results

```

```

two_factor

# PA1  PA2  h2  u2 com

# dis_prep      0.78 -0.04 0.57 0.43 1.0
# dis_soc       0.79 -0.01 0.62 0.38 1.0
# dis_exp       0.12  0.36 0.20 0.80 1.2
# dis_perception -0.01  0.57 0.31 0.69 1.0
# dis_stepshelp -0.04  0.77 0.56 0.44 1.0
# dis_confidence 0.11  0.58 0.43 0.57 1.1
# dis_awareness_effect 0.48  0.25 0.45 0.55 1.5
# dis_awareness_count 0.39  0.19 0.28 0.72 1.5


#          PA1  PA2
# SS loadings      1.79 1.63
# Proportion Var    0.22 0.20
# Cumulative Var    0.22 0.43
# Proportion Explained 0.52 0.48
# Cumulative Proportion 0.52 1.00


# cronbach's alpha for PA1 in the two factor model

psych::alpha(nhs |> dplyr::select(dis_soc, dis_prep, dis_awareness_count, dis_awareness_effect)) # 0.67


# cronbach's alpha for PA2 in the two factor model

psych::alpha(nhs |> dplyr::select(dis_stepshelp, dis_confidence, dis_perception, dis_exp)) # 0.68

```

```

# Testing a 4 factor model per the scree plot

# using an oblique rotation (items and factors are correlated)

four_factor <- psych::fa(nhs, nfactors = 4, fm = "pa", rotate = "oblimin", max.iter = 1000)

# Summary of the results

four_factor

# PA1  PA2  PA3  PA4  h2  u2 com
# dis_prep          0.57 0.02 0.15 0.06 0.50 0.50 1.2
# dis_soc           0.92 0.01 -0.02 0.00 0.83 0.17 1.0
# dis_exp           0.09 -0.04 0.05 0.45 0.25 0.75 1.1
# dis_perception    -0.03 0.03 -0.02 0.69 0.47 0.53 1.0
# dis_stepshelp     -0.05 0.78 0.01 0.03 0.61 0.39 1.0
# dis_confidence     0.11 0.65 0.00 -0.03 0.48 0.52 1.1
# dis_awareness_effect 0.20 0.07 0.45 0.12 0.49 0.51 1.6
# dis_awareness_count -0.03 0.01 0.76 -0.02 0.55 0.45 1.0

#
#          PA1 PA2 PA3 PA4
# SS loadings      1.37 1.11 0.93 0.77
# Proportion Var    0.17 0.14 0.12 0.10
# Cumulative Var     0.17 0.31 0.43 0.52
# Proportion Explained 0.33 0.27 0.22 0.18
# Cumulative Proportion 0.33 0.59 0.82 1.00

```

```
# cronbach's alpha for PA1 in the four factor model

psych::alpha(nhs |> dplyr::select(dis_soc, dis_prep)) # 0.76


# cronbach's alpha for PA2 in the four factor model

psych::alpha(nhs |> dplyr::select(dis_stepshelp, dis_confidence)) # 0.69


# cronbach's alpha for PA3 in the four factor model

psych::alpha(nhs |> dplyr::select(dis_awareness_count, dis_awareness_effect)) # 0.46


# cronbach's alpha for PA4 in the four factor model

psych::alpha(nhs |> dplyr::select(dis_perception, dis_exp)) # 0.46


# storing data

readr::write_rds(list(single_factor, two_factor, four_factor), file = "factor-results.rds")
```

## References

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