



# Propensity to Participate in Surveys with Physical Measures and Biomarker Collection: Potential Opportunities and Limitations

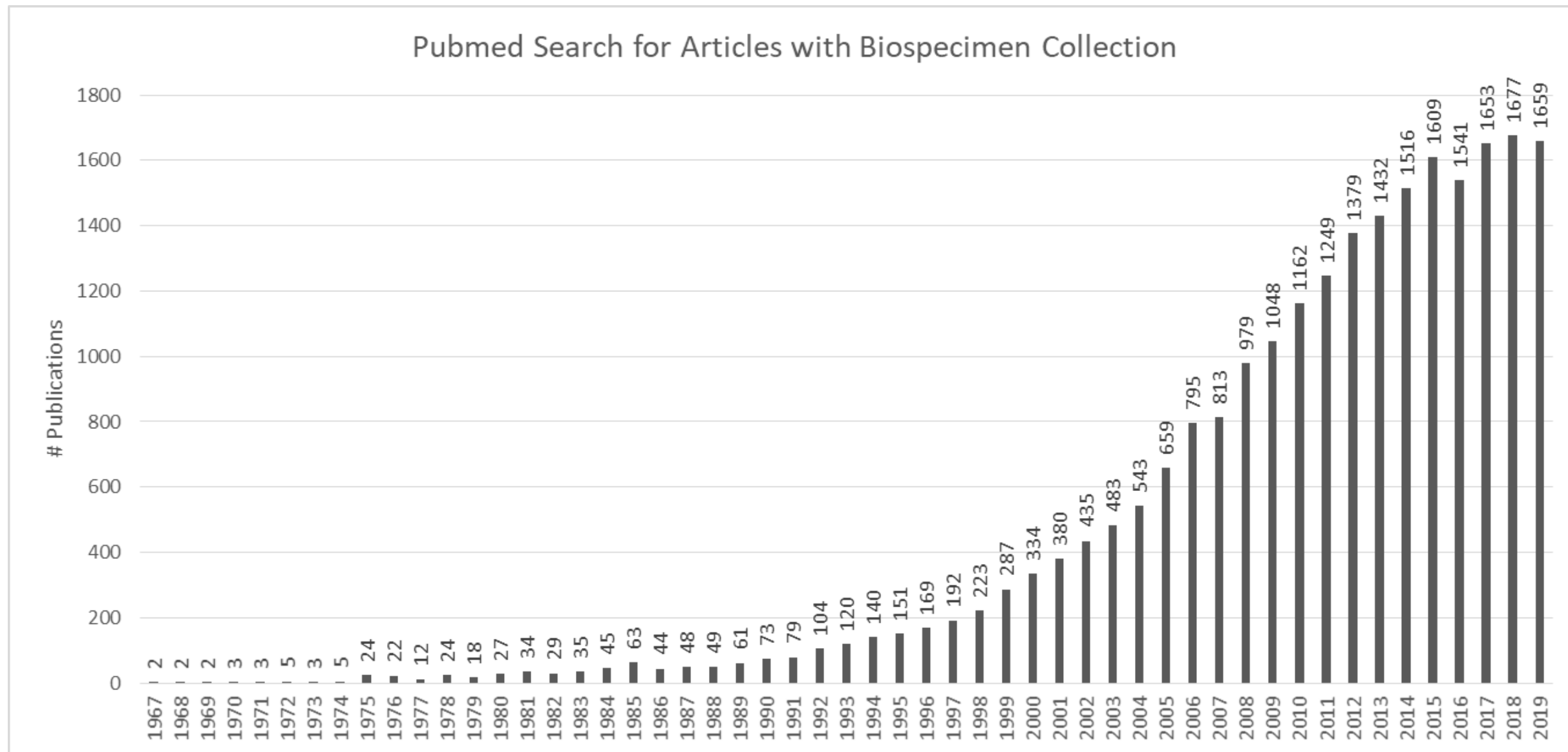
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# Physical Measures and Biomarkers in Health Surveys

- Most population-based **health surveys rely on self-reports** for adults or child-proxies about health and health conditions
- **Interviews** are efficient mechanisms for collection information about respondent characteristics, attitudes and reported behaviors
- However, they are likely to be **imprecise and incomplete for health status and health conditions**
- **Adding physical and biological measures** (bio-measures) to interview data can yield major benefits to health surveys
  - Calibrating self-reports with **more objective measures** of health and disease
  - Identifying **pathways and causal linkages** between social environment and health
  - **Linking genetic markers** to other survey materials
- The first and longest running national household health survey including physical measures and biological specimen collection in the United States is the National Health and Nutrition Examination Survey (NHANES) which was developed in the 1960s
- Since then, other health surveys at the cross-national, national, state and local levels have adopted these bio-measures

# Growth in Publications with Survey and Bio-measures: 1967–2019



Search using (survey OR questionnaire) AND (biospecimen OR biomarker OR gene OR genotype) attempting to replicate the methodology of Beebe from the 2007 HRSM Conference)



# Challenges for Health Surveys using Bio-measures

- Household surveys have been suffering **declining response** rates for two decades
- **Burden** is presumed to be a major factor in declining response rates
- Adding bio-measures to health surveys presumably increases **survey length** as well as adding **more intrusive measures** that might yield **more sensitive measurements**
- Between 1999-2000 and 2017-18, the unweighted **household interview rate for NHANES** fell from **82% to 51.9%**, while the unweighted **examination rate fell from 76% to 48.8%**
- Response rates are even lower for some key subgroups
- Relatively **little research** has been reported **on respondent willingness to participate** in surveys that involve bio-measures
- Understanding who is more or less willing to participate in these studies allows us to better understand **potential non-response bias** on key characteristics of the sample
- It also may permit us to use adaptive designs to minimize non-response biases by tailoring strategies to **subgroups who are less likely to participate in health surveys using bio-measures**

# ICF Dimensions of Participation Survey

- Purpose: formative research to **explore propensity to respond** to survey invitations among potential respondents **by asking directly about willingness to participate in surveys** under different conditions rather than to
  - **Indirectly infer propensity** to respond to surveys from comparing characteristics of **respondents to population characteristics**, or
  - Comparing characteristics of respondents from **baseline waves in panel studies** to those who complete subsequent waves or consent to additional data collection



# Survey Content in General Order of Presentation

- Health
  - Status
  - Chronic conditions and unmet needs
  - Health care utilization in past year
  - Interest and personal Importance of health
- Potential co-variates for participation
  - Housing, community, and community Involvement
  - Volunteerism
  - Political activity and voting
  - Information seeking behaviors
  - Close friends and attitudes toward friends
  - Trust in government and institutions
- Propensity of respond to surveys
  - General propensity to respond to surveys
  - Propensity to respond by survey design feature
    - Topic
    - Sponsor
    - Mode
- Attitudes toward government surveys
- Propensity to respond to government surveys
- **Propensity to participate in physical measures and specimen collection in household surveys**
- Willingness to participate in health surveys including medical examination
- Demographics

# Survey Methodology

- National mobile panel survey (2 million members)
  - National adult sample
    - Census balance sample drawn (gender, age and race) based on panel profile information
    - Mode: Smart phone internet
    - Initial smartphone invitation and three reminders over a two week period (3 sample loads)
    - Average interview length: 20 minutes
    - Incentive: Four Dollars for completed interview
    - Number of panelists invited: 6,095
    - Field Period: 7/28/18 – 8/31/18
    - Number of completed interviews: 1,937 (4 later eliminated as geographically ineligible)
    - Survey response rate: 31.8%
      - Response rate among active panel members (survey completions in past 2 months): 63.4%



# Weighting the panel data

- Sample was weighted to match population characteristics, or key demographics
- Population data were extracted from the American Community Survey (US Census ACS data)
- The adjustments used an iterative form of post-stratification, raking, which allows the use of additional variables and categories
- The following variables and categories were used in the raking
  - Gender
  - Age (18-24, 25-34, 35-44, 45-54, 55-64, 65+)
  - Race/ethnicity (Hispanic, Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Other)
  - Education (Less than HS, Completed HS, Some college/AA, College or more)





# Measure Willingness to Participate in Representative Bio-measures in Household Survey

## **Introduction:**

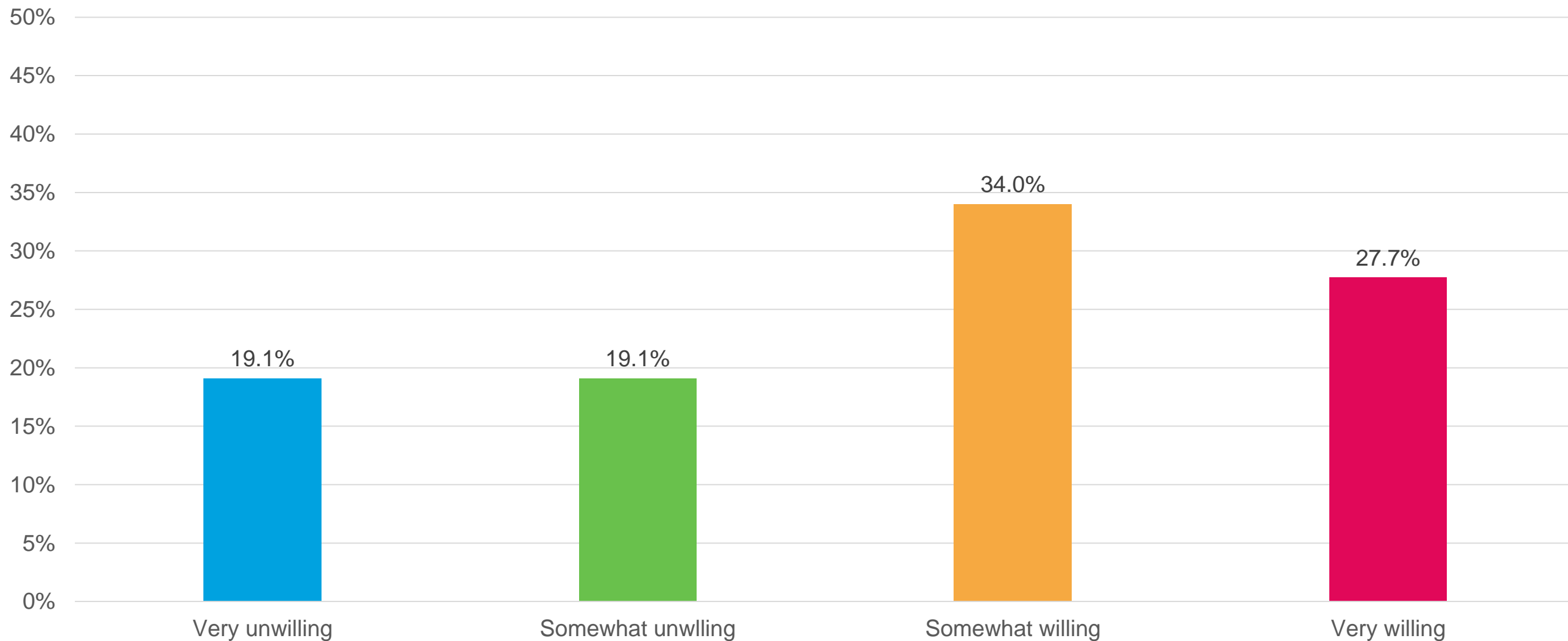
“Some of the most important health surveys need to measure respondents’ height and weight, blood pressure, take saliva samples, or ask permission for medical records in order to validate key study objectives. The next questions are about your general willingness to participate in health studies where a trained interviewer would conduct some of these additional measures in your home. We are not asking you to do these for any study.”

## **Individual questions about six bio-measures.**

Respondents were randomized to include (federal government health study or health study) in the text of each question. Same text across all six questions for same respondent.



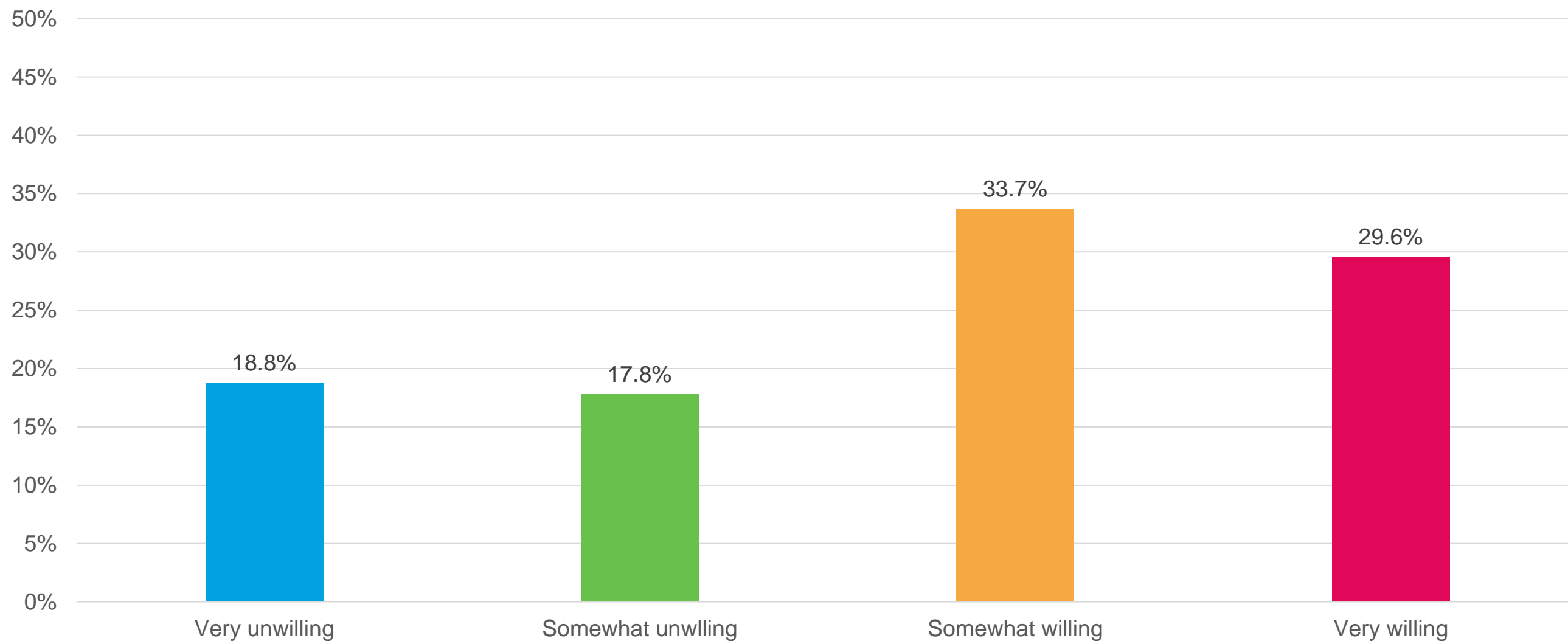
# Stated Propensity to Have Height and Weight Measured in Your Home



Q50. How willing would you be to have your height and weight measured by a health representative in your home for a (federal government) health study? N=1,933



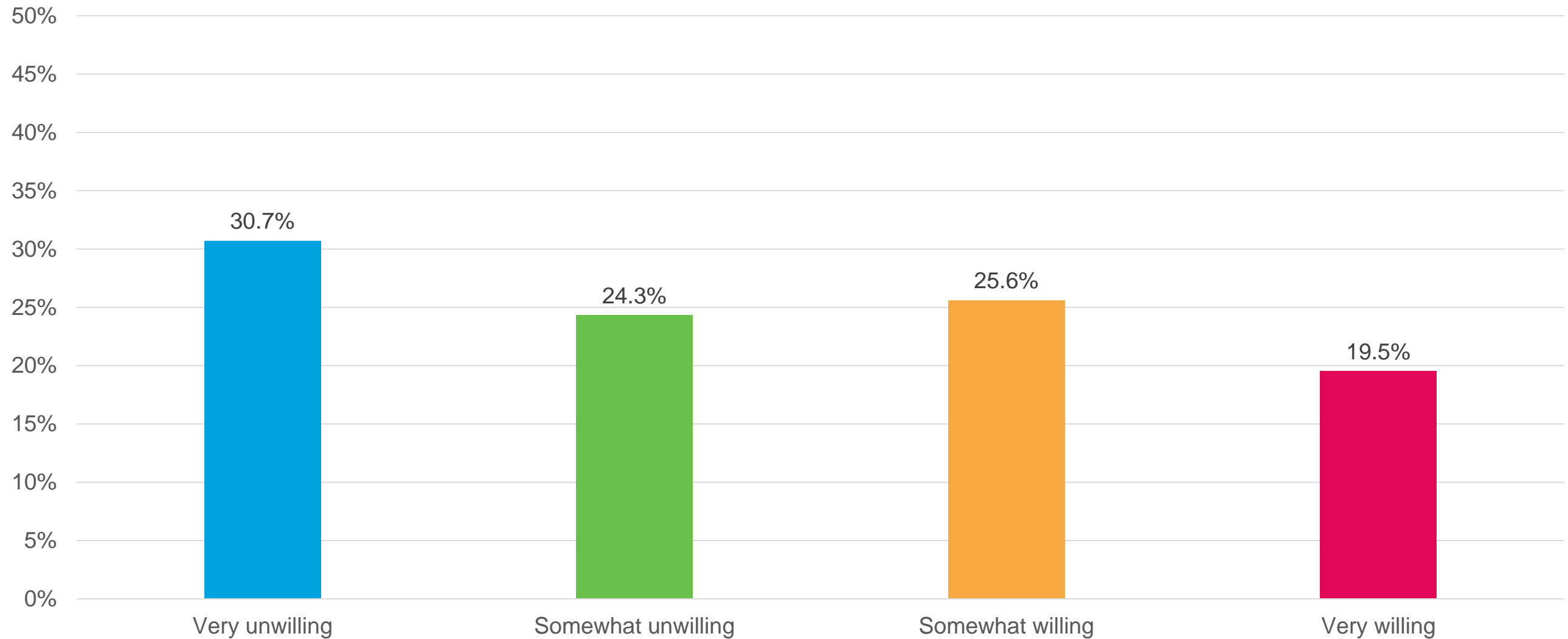
# Stated Propensity to Have Blood Pressure Measured in Your Home



Q51. How willing would you be to have your blood pressure measured by a health representative in your home for a (federal government) health study? N=1,933



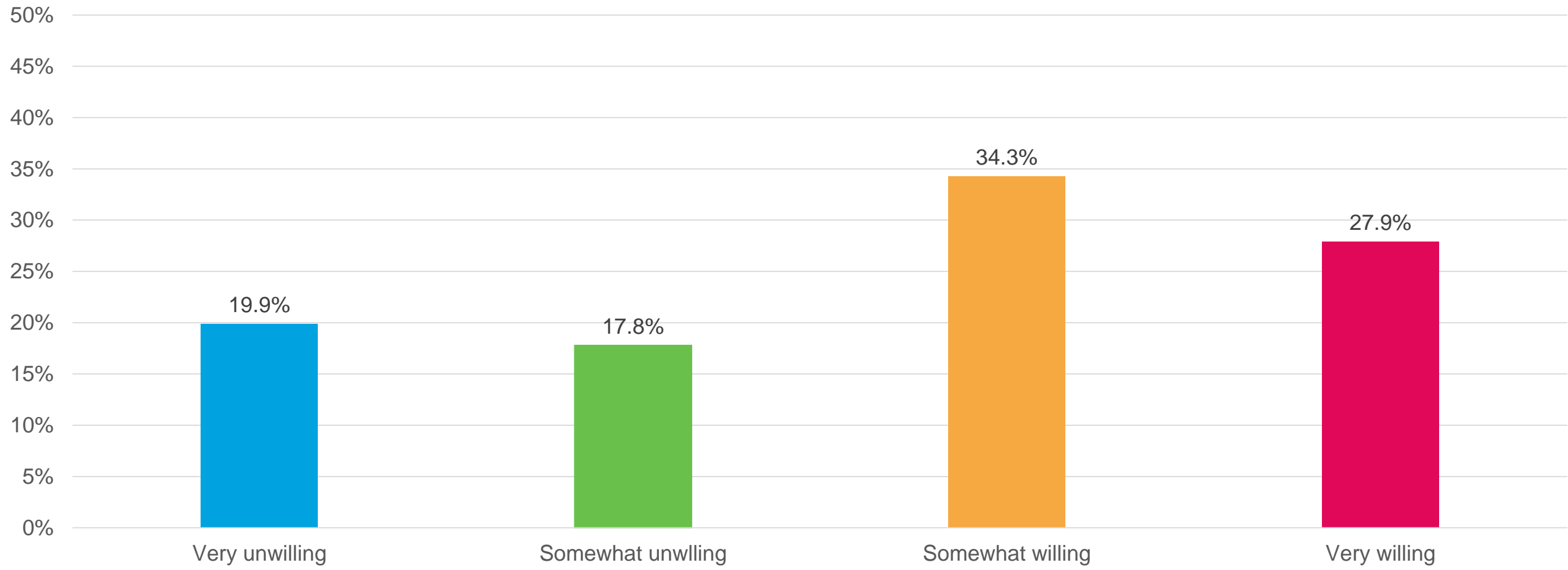
# Stated Propensity to Have Finger-Stick Blood Draw in Your Home



Q52. How willing would you be to have a health representative use a finger-stick to draw a small sample of blood from your finger in your home for a (federal government) health study? N=1,933



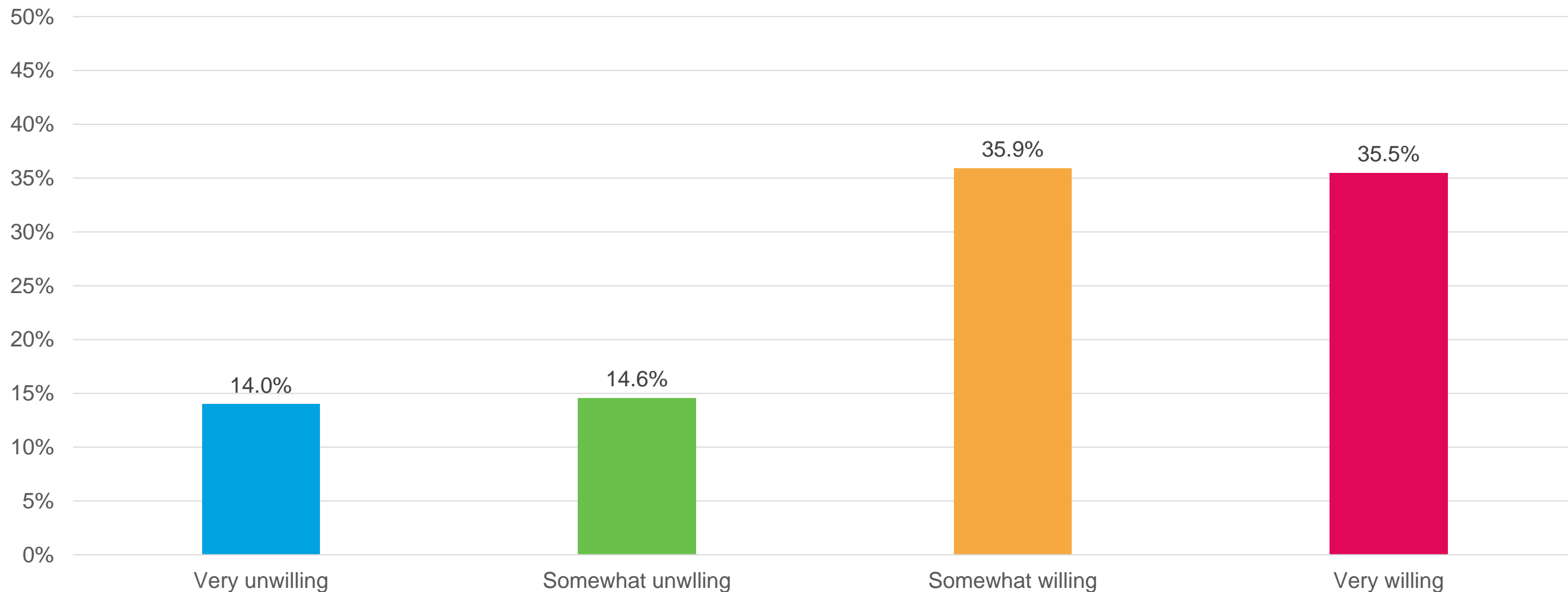
# Stated Propensity to Have Waist Circumference Measured in Your Home



Q53. Waist circumference is an important health measure. It is measured by YOU placing a tape measure over your clothes all the way around your body, at the level of your belly button. A health representative in your home would show you how to do it on themselves. How willing would you be to measure your waist size in your home for a (federal government) health study? N=1,933



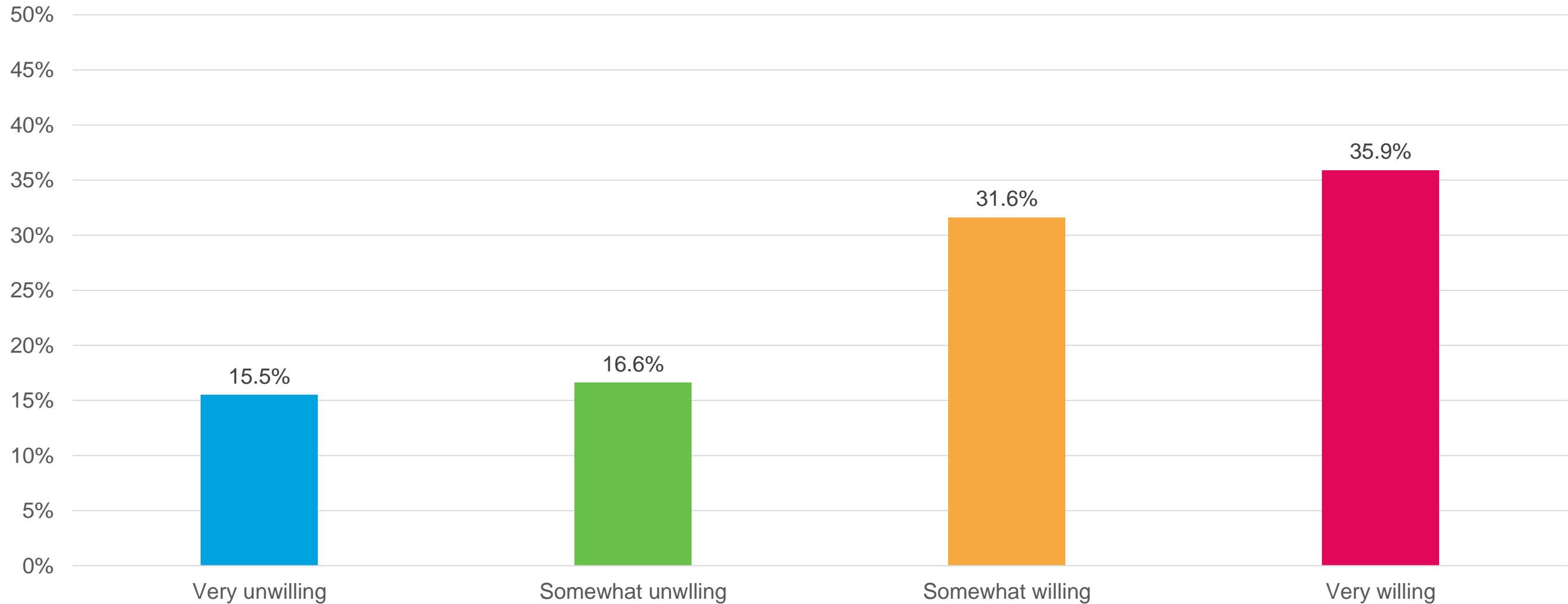
# Stated Propensity to Have Blood Pressure Measured by Machine in Your Home



Q54. Blood pressure can be measured by YOU using an automated machine in your home. If a (federal government) health study provided you with a machine and a health representative trained you to use the machine, how willing would you be to measure your blood pressure in the morning and evening for 3 consecutive days? N=1,933



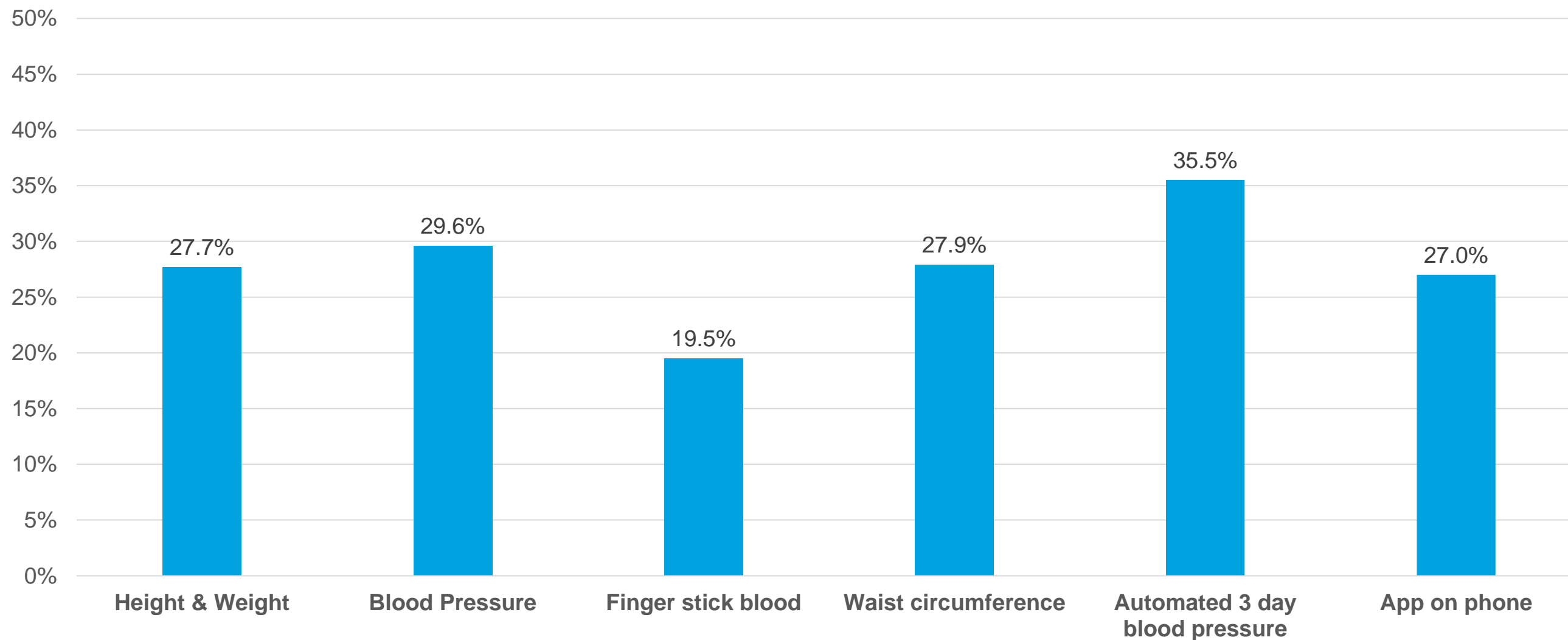
# Stated Propensity to Install an App on Phone for Health Study



Q55: How willing would you be to install an app on your phone to participate in a [federal government] health study? N=1,933



# Very Willing to Participate in Bio-measure in Health Study



Q55: How willing would you be to .... in a [federal government] health study? N=1,933





# Correlation Matrix of Willingness to do Bio-measures

| Total=1933   | Height and Weight | Blood pressure | Finger stick blood draw | Waist circumference | Blood pressure by machine | Install app |
|--|-------------------|----------------|-------------------------|---------------------|---------------------------|-------------|
| How willing would you be to have your height and weight measured by a health representative in your home for ..... ?   | 1                 |                |                         |                     |                           |             |
| How willing would you be to have your blood pressure measured by health representative in your home for ..... ?  | .893**            | 1              |                         |                     |                           |             |
| How willing would you be to have a health representative use a finger stick to draw a small sample of blood from your finger in your home for .... ?                     | .705**            | .735**         | 1                       |                     |                           |             |
| Waist circumference is an important health measure. It is measured by YOU placing a tape measure over your clothes .... ?  | .838**            | .836**         | .706**                  | 1                   |                           |             |
| Blood pressure can be measured by YOU using an automated machine in your home. If a ... study provided you with a machine and a health representative trained you .... ? | .696**            | .739**         | .614**                  | .748**              | 1                         |             |
| How willing would you be to install an app on your phone to participate in a health study?   | .518**            | .535**         | .484**                  | .508**              | .582**                    | 1           |
| ** Significant at .000   |                   |                |                         |                     |                           |             |

# Correlation Matrix of Willingness to do Bio-measures

| Total=1933<br>Federal government=941<br>Health study=992   | Height and Weight          | Blood pressure             | Finger stick blood draw    | Waist circumference        | Blood pressure by machine  | Install app |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|-------------|
| How willing would you be to have your height and weight measured by a health representative in your home for .... ?  | 1                          |                            |                            |                            |                            |             |
| How willing would you be to have your blood pressure measured by health representative in your home for .... ?   | .893**<br>.879**<br>.905** | 1                          |                            |                            |                            |             |
| How willing would you be to have a health representative use a finger stick to draw a small sample of blood from your finger in your home for .... ?                     | .705**<br>.717**<br>.692** | .735**<br>.738**<br>.731** | 1                          |                            |                            |             |
| Waist circumference is an important health measure. It is measured by YOU placing a tape measure over your clothes .... ?  | .838**<br>.804**<br>.870** | .836**<br>.807**<br>.863** | .706**<br>.707**<br>.702** | 1                          |                            |             |
| Blood pressure can be measured by YOU using an automated machine in your home. If a ... study provided you with a machine and a health representative trained you .... ? | .696**<br>.700**<br>.691** | .739**<br>.748**<br>.729** | .614**<br>.629**<br>.598** | .748**<br>.761**<br>.732** | 1                          |             |
| How willing would you be to install an app on your phone to participate in a health study?   | .518**<br>.539**<br>.501** | .535**<br>.546**<br>.527** | .484**<br>.514**<br>.456** | .508**<br>.517**<br>.492** | .582**<br>.572**<br>.581** | 1           |
| ** Significant at .000   |                            |                            |                            |                            |                            |             |

# Assessing the underlying Propensity to do Bio-measures

- **Restrict measures to most common bio-measures in household surveys:**
  - Height and weight measured by a health representative in your home?
  - Blood pressure measured by health representative in your home
  - Health representative use a finger stick to draw a small sample of blood from your finger
  - Waist circumference measured by YOU placing a tape measure over your clothes all the way around your body
- **Use polychoric correlations**
  - Measures correlation for two continuous variables represented by ordinal categories (e.g Very willing, Somewhat willing, Somewhat unwilling, Very unwilling)
  - “Here we have shown that when construct validity is analyzed according to ordinal data obtained from Likert scales, the factor results show a better fit to the theoretical model when the factorization is carried out using the polychoric rather than the Pearson correlation matrix.” (Holgado-Tello, et.al., 2010)

# Polychoric Correlation Matrix of Willingness to do Bio-measures

| Total=1933  | Height and Weight | Blood pressure | Finger stick blood draw | Waist circumference |
|---|-------------------|----------------|-------------------------|---------------------|
| Height and weight measured by a health representative in your home?                                       | 1                 |                |                         |                     |
| Blood pressure measured by health representative in your home   | .940**            | 1              |                         |                     |
| Health representative use a finger stick to draw a small sample of blood from your finger                 | .809**            | .842**         | 1                       |                     |
| Waist circumference measured by YOU placing a tape measure over your clothes all the way around your body | .901**            | .898**         | .810**                  | 1                   |

\*\* Significant at .000



# Willingness to do Bio-measures Index

- Factor analysis to determine underlying factors
  - Principal component
  - 1 Factor explains 90% of the variability of these 4 measures.
  - The measures are roughly equal weight in the factor score

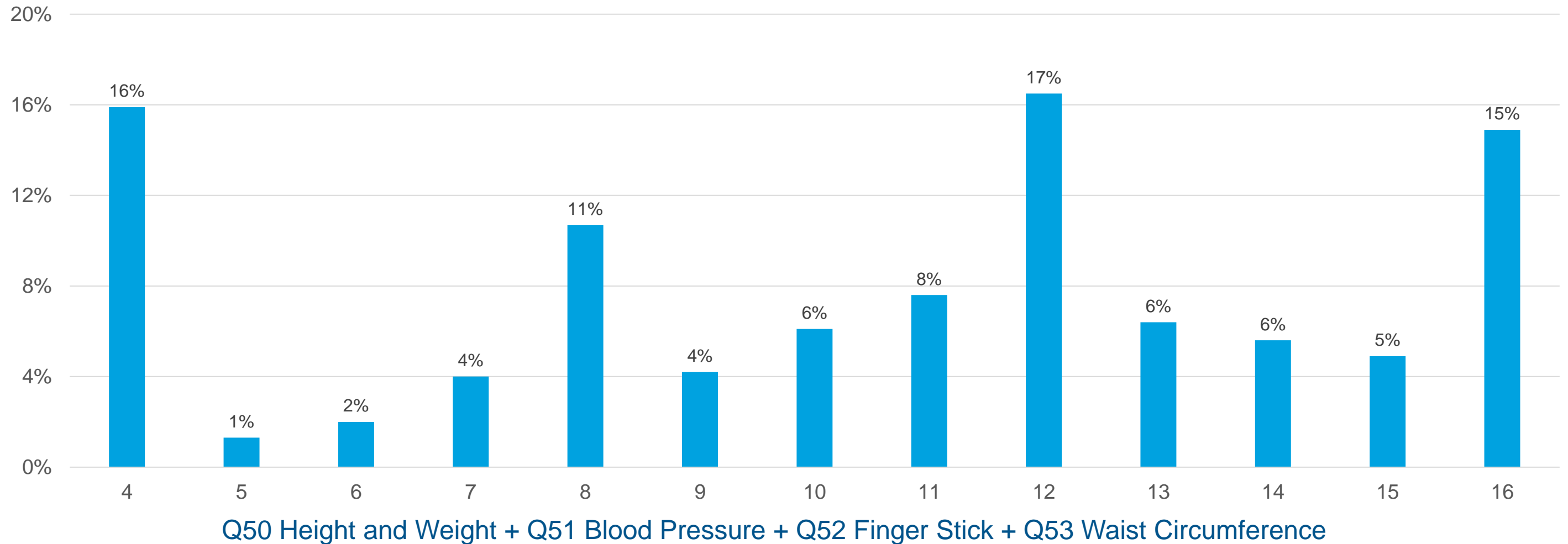
## Standardized scoring coefficients:

|                     |       |
|---------------------|-------|
| Height and weight   | 0.253 |
| Blood pressure      | 0.253 |
| Finger stick        | 0.250 |
| Waist circumference | 0.252 |

- Create a measure of the latent propensity to participate in bio-measures
  - Operationalized by creating a simple additive willingness index: (Height and weight) + (Blood pressure) + (Finger stick) + (Waist circumference) = Index score ( 4 to 16)



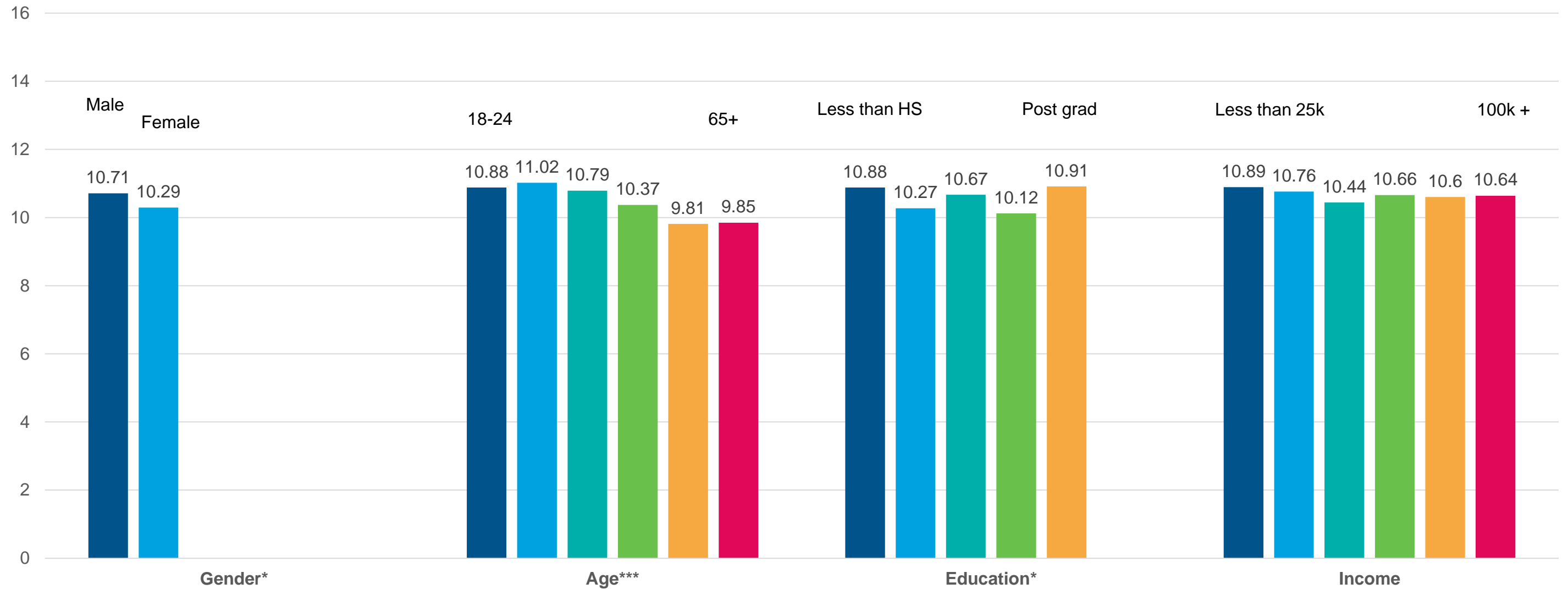
# Propensity for Bio-Measures Index (low is unwilling and high is willing)



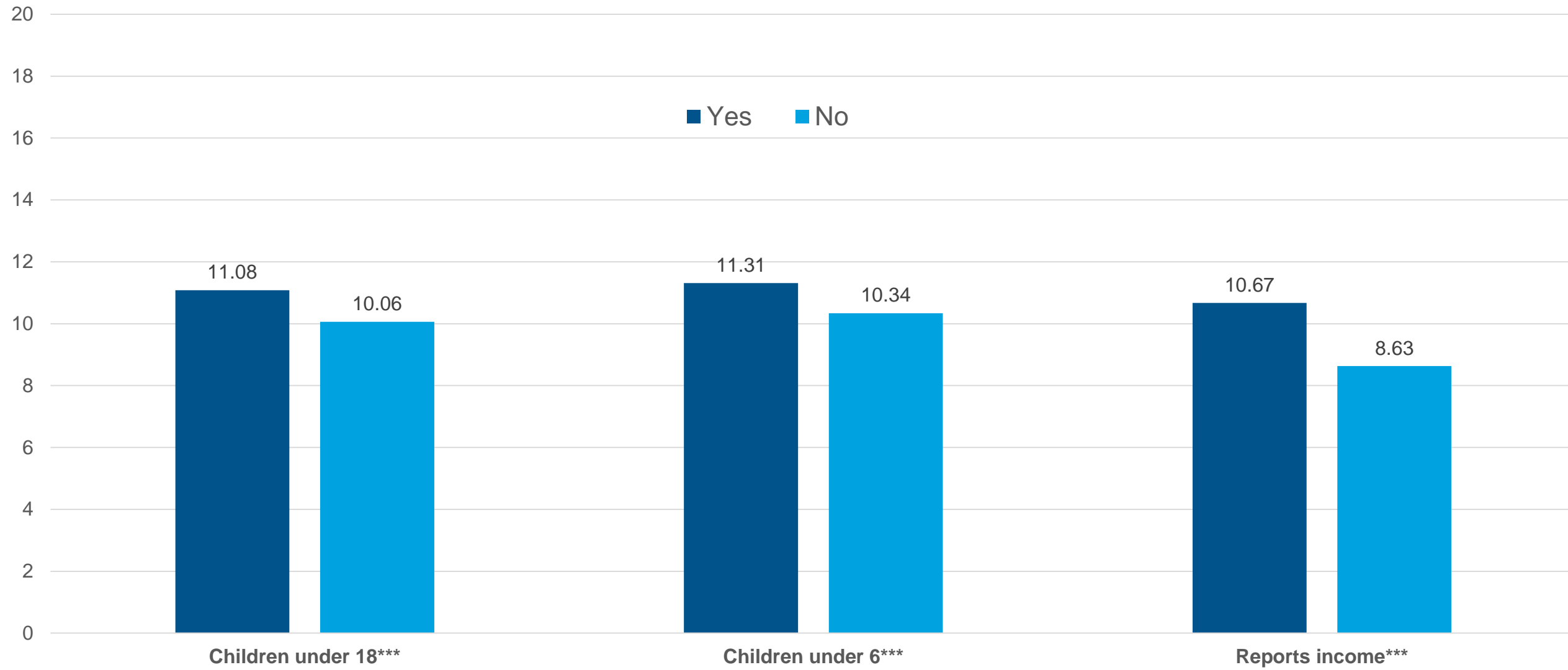
Mean Total (1933) = 10.49



# Index Propensity for Bio-measures by Demographics (1)

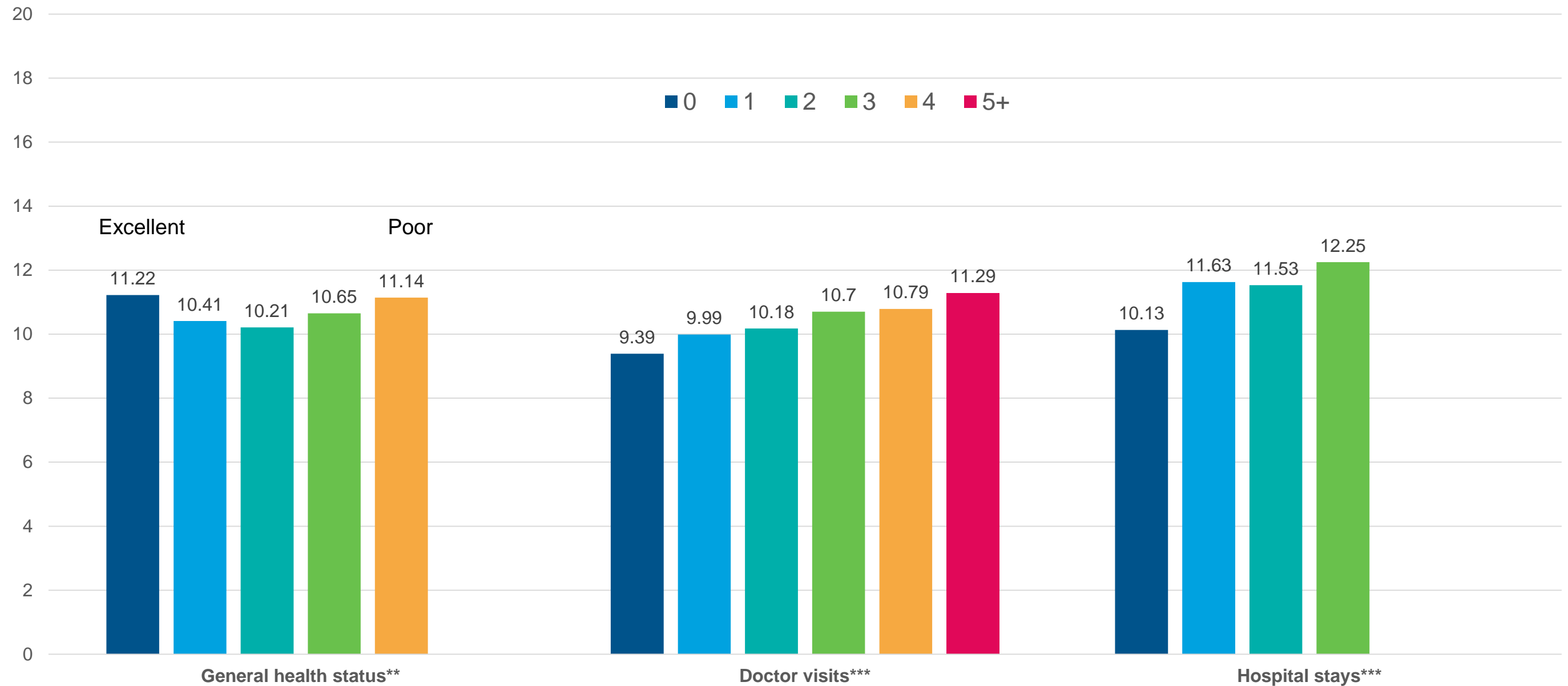


# Index Propensity for Bio-measures by Demographics (2)

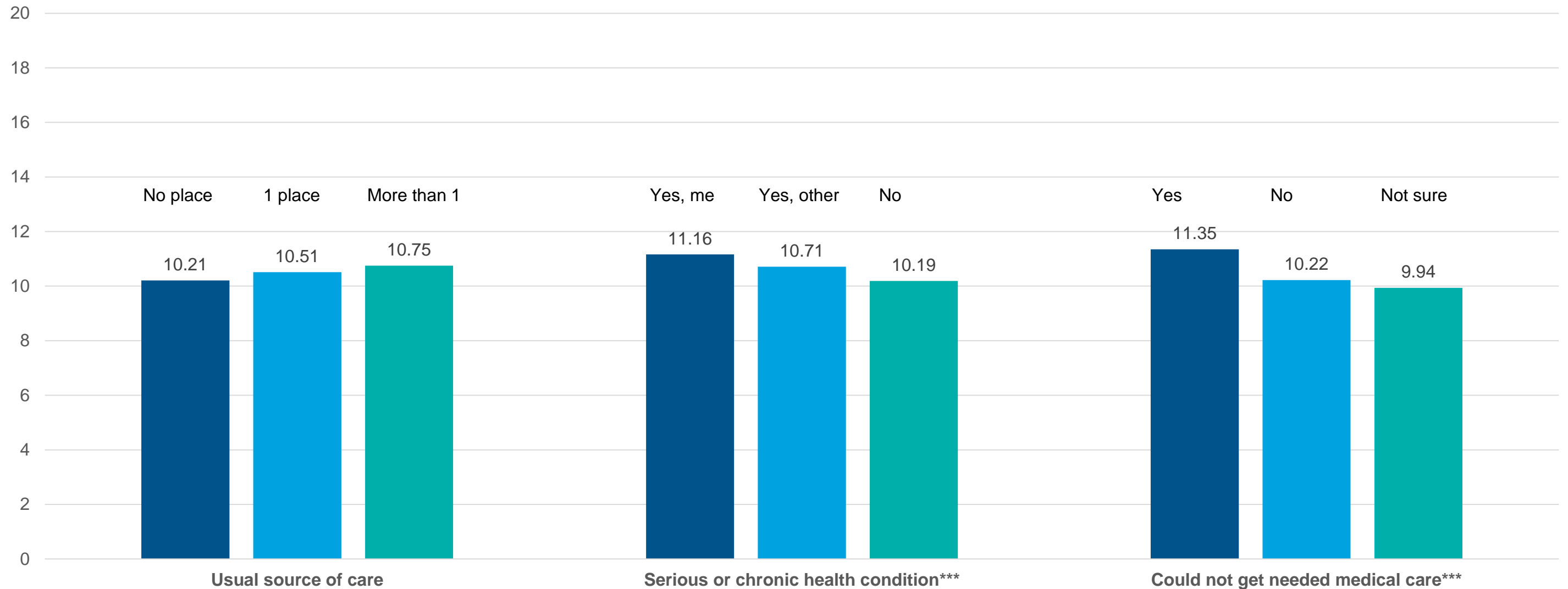




# Index Propensity for Bio-measures by Health (1)



# Index Propensity for Bio-measures by Health (2)



# Conclusions

- The survey finds that in a large and diverse national sample of adults, willingness to participate across a range of physical measures and biological specimen collection is very highly correlated.
- The high correlation of measures that include physical measurements and bio-specimen collection, interviewer administered and self-administered, suggests a latent propensity for bio-measures that underlies their response to specific bio-measures.
- Using a simple additive scale across the four most traditional types of bio-measures administered by interviewers (health representatives) in household surveys (height & weight, blood pressure, finger stick, waist circumference), we constructed a bio-measure propensity index to reflect the latent propensity in potential respondents
- The propensity index is somewhat higher in males than females, falls consistently from age 25-34 to age 55 and older respondents, and is higher among African-American and Hispanic respondents than white respondents, while education is not clearly related to propensity and household income is not at all related (except those who refuse income have a much lower propensity to participate).
- More importantly for health surveys, the propensity to participate in bio-measures is higher for those with chronic or serious health conditions, those who could not get need medical care in the past year, and increases with the number of doctor visits (up to 5 visits) and more hospitalizations in the past year.
- Hence, the survey suggests that the general propensity to participate in household surveys with bio-measures would tend to bias the sample towards persons with serious and chronic conditions, unmet health needs, and multiple visits to the doctor and hospital.
- It should be noted that general or latent propensity is only one dimension of survey participation, and may be modified by structural barriers, specific survey design features, and temporary factors which interact with general propensity.
- Nonetheless, if these findings are validated in probability samples, or perhaps until they are disproven, researchers should consider an adaptive designs to tailor specific survey design features to appeal to population segments that are likely to have lower general propensity to respond to surveys with bio-measures.



we are  **ICF**

# Thank You

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ICF Survey Research

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# Polychoric Correlation Matrix of Willingness to do

| Total=1933<br>Federal = 941<br>Health study = 992   | Height and Weight          | Blood pressure             | Finger stick blood draw    | Waist circumference        | Blood pressure by machine  | Install app |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|-------------|
| Height and weight measured by a health representative in your home?                                       | 1                          |                            |                            |                            |                            |             |
| Blood pressure measured by health representative in your home   | .940**<br>.930**<br>.951** | 1                          |                            |                            |                            |             |
| Health representative use a finger stick to draw a small sample of blood from your finger                 | .809**<br>.821**<br>.797** | .842**<br>.845**<br>.838** | 1                          |                            |                            |             |
| Waist circumference measured by YOU placing a tape measure over your clothes all the way around your body | .901**<br>.875**<br>.926** | .898**<br>.874**<br>.921** | .810**<br>.809**<br>.810** | 1                          |                            |             |
| Blood pressure can be measured by YOU using an automated machine in your home.                            | .784**<br>.783**<br>.785** | .827**<br>.831**<br>.823** | .735**<br>.747**<br>.722** | .835**<br>.840**<br>.827** | 1                          |             |
| How willing would you be to install an app on your phone to participate in a health study?                | .614**<br>.628**<br>.607** | .632**<br>.633**<br>.638** | .582**<br>.608**<br>.560** | .604**<br>.604**<br>.599** | .681**<br>.667**<br>.689** | 1           |
| ** Significant at .000  |                            |                            |                            |                            |                            |             |