The National Social life, Health, and Aging Project Technical Report on Medication Coding

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Introduction:
Wave I of The National, Social life, Health and Aging Project (NSHAP) collected medication data from a national probability sample of 3,005 participants ages 57-85 years. An approximately 120-minute survey questionnaire was conducted which consisted of an in-home interview, collection of biological and physical measures, and medication data. Using a Computer Assisted Personal Interview (CAPI)-based medication log, the interviewer observed and recorded all prescription, over-the- counter (OTC), vitamins or nutritional supplements, and herbal and alternative therapies used by the respondent on a regular basis. The interviewer asked to view all medication containers, and directly recorded names of medications. Specifically, the respondent was asked: "to record all medications that you take on a regular schedule, like every day or every week. This will include prescription and non-prescription medications, over-the-counter medicines, vitamins, and herbal and alternative medicines. Do you have all your medicines here?" Respondents were also asked several questions related to medication use[1]. Just under 5% of drug entries appeared to be spelled phonetically, indicating that some medications were not directly observed, but rather were orally reported by the respondent. Fewer than 1% of respondents (n=28) refused to participate in the medication log and questions pertaining to medications during the interview. Wave I data collection was completed began July 2005 and was completed March 2006. The non-weighted version (v1) of the final dataset was used to generate this report.

The purpose of this section of the report is threefold:
1) Describe the steps involved in coding the medication data in the NSHAP database
2) Provide a reference for the values used in coding the data
3) Present an algorithm summarizing the coding of the medication data (Table 4).

Medication Coding for NSHAP
Several steps were involved in the drug coding process. First, the original recorded observations in STATA were collapsed in order to combine capital and lowercase same drug observations. This step in cleaning the data reduced the number of observations from 15,426 to 5,826, which made the data more manageable. The drug data were then imported from Stata [2] to Excel [3] in alphabetical order with the recorded drug name and frequencies for each drug mention. The initial process of coding the drug data involved the following steps with guidelines reached after discussions and consensus among co-authors familiar with the data.

1. Corrected spelling errors and typos (approximately 15% of entries).
2. Included identifiable foreign names.

[1] The National, Social life, Health and Aging Project In-Person Interview and Leave-behind Questionnaire. May 2006, p. 65.

3. Included unknown drug names during this phase.[2]
4. Did not include strength (approximately 20% of drug entries had strength recorded) with the exception of aspirin and aspirin-containing products with a strength recorded (81mg/"lower strength" or 325mg/"regular strength").
5. Combination drugs were not broken down in this phase as separate values, but each ingredient was separated by a "/" or "," for consistency.
6. Multivitamins or multivitamin products with no brand name recorded were coded as 'multivitamins,''multivitamins/minerals,' 'multivitamins/additional ingredient recorded' (e.g. herbs or calcium, iron, etc).
7. Single vitamins or combinations of single vitamins/herbals were recoded by separating each ingredient by a "/" or ",".
8. Vitamins with more than four single ingredients were coded as "multivitamins."
9. Vitamins or dietary supplements that were generically recorded without reference to trade name, e.g. "Vision Formula" or "cholesterol vitamin" were recoded as "eye vitamins" or "cholesterol vitamin," respectively.
10. Vitamins and dietary supplements that were not broken down (because they had more than four ingredients) were coded as they were recorded by the data collector in most cases. Examples include Centrum® and I-caps®. [3]
11. Drug entries that included intended use of drug or indication (e.g. "blood pressure med" or "allergy med OTC" or "diabetes medicine" etc.) were recoded as such with consistency in recoding if observed more than once.
12. Excluded formulation for drug entered, unless recorded as eye drop, cream or patch and formulation is otherwise ambiguous by drug name.
    e.g. tac cream→ traimcinolone cream
    prednisolone ophthalmic→ prednisolone drops
    voltaren ophthalmic→ voltaren drops

After recoding the drug data using thesecriteria, the data were collapsed in STATA[4] and the number of observations was reduced to 1315.

Table 1 illustrates, using a sample of prescription, over-the-counter drugs and vitamins, most of the processes involved in coding the drug data in the NSHAP medication profiles.

2 The National Drug Code directory is accessible online at http://www.fda.gov/cder/ndc/database/ and Micromedex is accessible via the University of Chicago Library online database. The National Drug Code Directory and Micromedex Drugdex were the primarily references used when coding the drug data.

[3] Micromedex Drugdex which is accessible via the University of Chicago Library and the National Library of Medicine database for drugs and natural products are references that make available components of combination products and multivitamins which is accessible online at http://www.nlm.nih.gov/medlineplus/druginformation.html

[4] StataCorp. 2005. Stata Statistical Software: Release 9. College Station, TX: StataCorp LP.

Table 1: Mapping of Drug Coding Process

New Codes	Drug Name Recorded by Interviewer
aciphex	acidphex acifex aciphex aciphex 20 mg aciphex 20mg aciphex 20mg 1xdaily
actonel	acotonel actanol actinol actonel actonel 35 mg actonel 35 mg.
aleve	aleve aleve - 0ne 2xdaily aleve 220 mg
aspirin 81	81 gr aspirin 81 mg aspirin 81 mg of asprin 81 mg. aspirin 81 mgs aspirin 81 ml asprin adult asprin 80 mg adult low strength aspirin
avapro	auapro avapro avapro 75 avapro 150 mg
caltrate d	caltrade d caltrate + d caltrate 600 d
multivitamin	1 multi vitamin 1-a-day vitamin a multi-vitamin a-z vitamin abc complete multivitamin advance multi advanced formula century advanced multi-vitamin alpha base multi vitamin athruz vitamin
multivitamin, iron	multiple vitamins w/iron multivitamin with iron

The following describes the final steps involved in the primary coding of the drug data (1,315 values):

1. Using Micromedex first, then the National Drug Code (NDC) drug directory, and lastly the National Library of Medicine, Medline Plus Drug and Supplement Database and the Natural Standard Database for Herbs and Natural products, drugs (in most cases) were recoded to chemical names. [5]
2. Spelling errors that were missed during the first phase were corrected.
3. The search engine Google™ (www.google.com) was used to search for drug names that were not found in any of these drug references. Drugs listed in Table 2 were identified using this process. Most were found to be over-the-counter product trade names, foreign drug names, unknown drugs or herbal products sold online or at specialty vitamin centers. When a drug was identified as a prescription medication that was spelled incorrectly, the National Drug Code Directory or Micromedex was used to confirm drug criteria.
4. Combination drugs (prescription and non-prescription) with up to four chemical active ingredients were recoded as separate values (Chemical 1, Chemical 2, Chemical 3, Chemical 4). There is no particular order in which they were coded as "1" or "2" or "3" or "4."
5. Combination drugs/multivitamins with more than four chemical active ingredients were not recoded with a different value. For example, Centrum® multivitamins were not broken down by individual vitamins, since there are more than four chemical ingredients (single vitamins).
6. A total of 54 drug entries were not coded due to unknown names or observation not applicable (e.g. glucose test strips).
7. Drugs variables and values were then coded as described in Table 3.

[5] Medline Plus Drug and Supplements Database is accessible online at http://www.nlm.nih.gov/medlineplus/druginformation. The National Drug Code (NDC) directory is accessible online at http://www.fda.gov/cder/ndc/database/. Micromedex Drugdex database is accessible to authorized users via the University of Chicago Library database.

Table 2: Drugs identified using the Google™ Search Engine

abgone
adrenogen
advaclear
allerclear
apo hydro
banisteria caapi
barefoot coral calcium plus
bee alive feel good formula
bee pollen
biocalth bone and joint
cardiovitamin
cartomax
chlorella
clopilet
collagenics
colostrum
cortidrene
cynoplus
feelanew
femgest
feminine balance
flax-o-mega
fosalan
garden of life
glucobalance
"herballife derivatives"
Immuplex
Jade green zymes
Jevity
Joint advantage
Joint and muscle comfort plus
"legacy derivatives"
legatrin
lentel
lifeguard antioxidant
lipovitan
lomalux
lubriflex
luporium sots
panzyme
"pathway derivatives"
Pressassure
Protegra
q-gel plus
"reliv derivatives"
relora
rutozym
thymuril
tracleer
vidoplex

Table 3: Variables and Values Reference for Drug Coding

Combination Status Combination drugs (brand or generic), with up to four chemical ingredients, were broken down. Otherwise the recorded name of the drug was used. 1=Yes a combination product (more than one active ingredient) 2=No not a combination product (only one active ingredient) 3=Not known/Not available
Brand Status 1= Brand name recorded 2=Generic/chemical name recorded 3=Not known
Regulatory Status 1= Prescription (Rx) only 2=Over the Counter (OTC)-includes analgesics (topical and oral), laxatives, cold/cough, antacids, topical creams and gels, anti-gas, eye drops, anti-fungals, weightloss products, nutritional formulas/shakes. 3=Rx and OTC (varies by strength e.g. naproxen and ibuprofen) 4=Herbal/ Dietary Supplements (Multivitamins, Multivitamins and minerals, vitamins, herbal and other dietary supplements) 5=Not known
Rx Sexual Enhancing Medications 1=Yes (FDA indicated Rx medications for sexual and/or erectile dysfunction and testosterone therapy). There are no FDA approved drugs for the treatment of female sexual dysfunction, therefore unless a female respondent specifically indicates she is taking a specific drug for sexual enhancement, there may be cases where a drug has a prosexual side effect but that drug was not identified in response to this question. 2=No

Table 4: Drug Coding Algorithm

Identify Drug Recorded in Medication Log
(do not recode brand name to generic name)

Step 1

Is drug name recorded recognized?

YES → Correct spelling and recode

NO → Look up drug name in Micromedex, National Drug Code directory or Natural Standard → **Was drug Identified?**

- YES → Correct spelling if necessary and recode
- NO → Google Drug name → **Was Drug identified?**
  - YES → Correct spelling and recode
  - NO → Leave blank and consider unknown

Step 2

Is drug an Aspirin product?

YES → Include strength (e.g. children's Bayer aspirin would be recoded as Bayer 81)

NO → Do not include strength

Is drug a combination product or multivitamin?

YES → **Does it contain more than four chemical ingredients [look up drug name in Micromedex]?**

- YES → Then recode with trade name (e.g. Centrum® would be recoded as Centrum and not as separate values)
- NO → Then recode each ingredient and separate by "," or "/"

NO → **Is drug entered a combination of single vitamins or mineral or herbals?**

- YES → **Are there more than 4 ingredients?**
  - YES → Recode as multivitamin
  - NO → Record each ingredient and separate by "," or "/"
- NO → **Is drug single vitamin?**
  - YES → Recode as single ingredient

Does drug recorded mention formulation or route of administration?

YES → **Is it available in more than one formulation?**

- YES → Recode formulation after drug name
- NO → Do not include formulation

N0 → Do not record formulation

Is recorded 'drug name' not a drug, but rather an indication or use for a specific class of drugs?
YES → Recode with therapeutic indication (e.g. "Vision formula" would be recoded as eye vitamin and "cholesterol vitamin" would be recoded as such)
NO → Recode according to aforementioned criteria

Coding chemical names and variables

Is drug recoded a generic drug name?

→ **Is it a combination product with four or less ingredients?**

YES
- YES → Recode each chemical ingredient as a separate value (Chemical 1, Chemical 2, Chemical 3, and Chemical 4)
- NO → Recode single drug chemical ingredient or vitamin name under "chemical 1"

NO → **Is it a trade name (including foreign trade names) combination product with four or less ingredients?**
- YES → Recode each chemical ingredient as a separate value (Chemical 1, Chemical 2, Chemical 3, and Chemical 4)
- NO → Recode single drug chemical ingredient or vitamin name under "chemical 1" and if more than 4 ingredients recode with brand name under "chemical 1"

Using Table 3 as reference for variable values recode if necessary the following:

1. Combination Status
2. Brand Status (as recorded by data collector)
3. Formulation (route of administration): if drug entered without reference to formulation, but product is available in one formulation, then code with that formulation. If product is available in more than one formulation and it is not indicate in database, then recode as unknown formulation.
4. Regulatory Status: The NDC drug directory was the primary resource for verifying RX only drugs. For over-the counter drugs that are also available as prescription drugs (at higher strengths or different formulations) they were coded as "RX and OTC."
5. If drug is a "prescription sexually enhancing medication," " nonprescription sexually enhancing medication ," "Hormone replacement therapy," "Non-Rx product for relief of menopausal symptoms" and "medication for Diabetics."

Coding Medication Data for Drug and Therapeutic Categories

Coding drugs for therapeutic categories utilizes the Multum® Drug Database, which is based on the American Hospital Formulary Service therapeutic categories. The Multum® drug category database is accessible online, with authorization by the Multum Company[6]. For NSHAP purposes, the Multum Lexicon Plus version was used.[7] Two entities in the Multum database are of relevance for the coding of therapeutic category information. Rows in the MULTUM_DRUG_ID table represent generic chemicals, without any associated brand or packaging information. Some of these rows represent combination drugs, composed of one or more member drugs. Rows in the MULTUM_DRUG_CATEGORY table represent therapeutic categories. These categories are organized into a three level hierarchy. Each drug represented in the MULTUM_DRUG_ID table belongs to one or more of these categories.

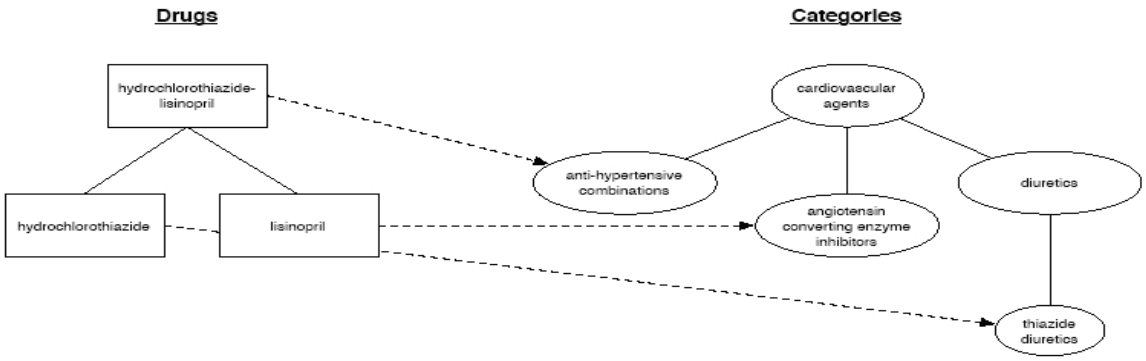
An attempt was made to match most verbatim responses to records in the MULTUM_DRUG_ID table. The exceptions are responses that would have fallen into the Multum® categories "alternative medicines"and "nutritional products." Multum's coverage of these categories is not complete, and the information recorded by the interviewer for these products was sometimes insufficient to distinguish between specific Multum drug IDs. Of the 15,426 total response lines, 3,690 were determined to be nutritional products or alternative medicines, 11,510 were matched to Multum Drug IDs, and 226 were unmatched.

If a verbatim response was matched with a Multum drug, every category that Multum places the drug into is recorded in the dataset. Each category is represented as a series of three variables, so that every level of the Multum category hierarchy can be recorded. When Multum places a drug in a category we say that the drug is directly associated with that category. For instance, in Figure 6, the drug "hydrochlorothiazide" is directly associated with the category "thiazide diuretics"

We provide additional information in the case of combination drugs. It is possible, as in the case illustrated by Figure 6, that the member drugs of a combination belong to some categories which the combination drug does not. For instance, drug "hydrochlorothiazide-lisinopril" in the Figure 6 is directly associated only with the category "anti-hypertensive combinations." However, its member drug, "hydro-chlorothiazide," is associated with the category "thiazide diuretics." In this case, we say that "hydrochlorothiazide-lisinopril" is indirectly associated with "thiazide diuretics." These indirect associations are recorded in a separate series of variables.

[6] More information on Multum® is accessible online at www.multum.com.
[7] More information on Multum® is accessible online at www.multum.com.

Figure 1: Example of Multum Drug Classification



Preliminary Exploration of Medication Use in the National Social life Health and Aging Project

After coding was completed, an exploration of the medication data in the NSHAP sample was conducted.

Methods:

In an attempt to provide a preliminary overview of the NSHAP pharmacological data, the primary measures described here include: the mean number of total medications, prescription-only medications, over the counter medications and herbal/dietary supplements (including multivitamins). Responses to questions included in the interview were also analyzed: Question 1: "In the past 12 months have you taken a prescription or non-prescription, OTC medication or herbal supplement to improve sexual function?"; Question 2: "In the past 12 months have you stopped taking a prescription, OTC, or herbal supplement due to sexual side effects?"; and Question 3: "Since menopause have you used prescription hormones?" Data were analyzed using Stata 9.2[2] to for preliminary exploration of the non-weighted dataset.

Results:

Non-response for all components of the study related to medication use was <1% Medication use measures are stratified by age group and gender (Table 5). Future analysis may, of course, include ethnicity, self-reported health status, co-morbidity, income, insurance status, education, etc.

Table 5 presents the mean number of medications per respondent by age group and gender. The mean number of total medications was 5.18 among all respondents completing the medication log: mean number per individual of prescription medications =3.41, OTC medications = 0.46 and herbal products, dietary supplements and multivitamins = 1.12. The mean number of herbal products/dietary supplements was highest in the 65-74 year age group. The mean number of total, prescription-only, OTC and herbal and dietary supplements was higher for women than men. Figure 2 illustrates the distribution of median number of medications by age group and gender. Approximately 91% of individuals in the NSHAP sample reported using at least one medication; approximately 60% reported five or fewer medications. Figures 3 through 6 present the range of values for number of medications by category, age group and gender. Women were slightly more likely than men to report medication use (93% versus 88%,

respectively). As Table 5 illustrates, the prevalence of medication use among men was highest in the oldest age group (95%) and among women in the 65-74 year age group (95%).

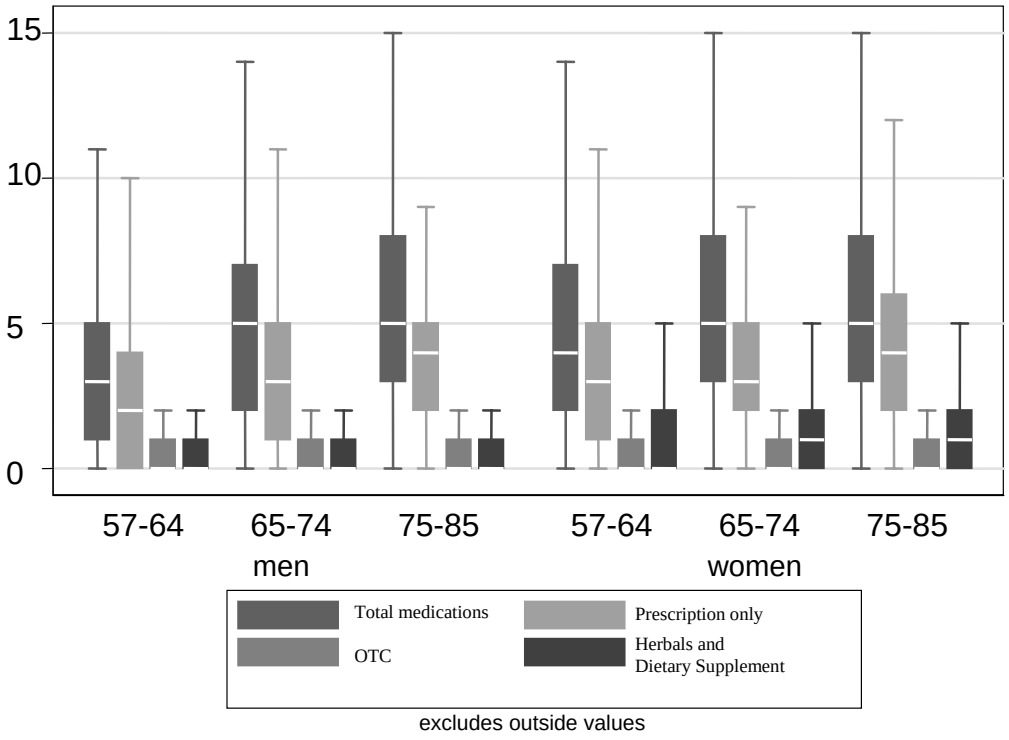
Table 5: Mean Numbers (unweighted) of Total Medications, Prescription only medications, Over the Counter (OTC) and Herbal/Dietary Supplements (including Multivitamins) Per Respondent by Age group and Gender.

	57-64 Years		65-74 Years		75-85 Years		Total
Outcome Measure	Male (n=525)	Female (n=491)	Male (n=523)	Female (n=539)	Male (n=376)	Female (n=502)	(n=2976)
Total Medications	3.5	5.2	5.2	5.9	5.6	5.8	5.18
Rx Only Medications	2.4	3.2	3.4	3.8	3.8	3.9	3.41
OTC Medications	0.3	0.4	0.5	0.5	0.5	0.5	0.46
Herbal and Dietary Supplements	0.7	1.3	1.1	1.4	1.0	1.2	1.12

Note: 28 respondents refused to participate in the medication log.

The following figures (figure 1 through figure 5) are presented to illustrate the distribution of the number of medications (ranging from 0 to 20) and median number of medications by gender and age group.

Figure 2: Boxplot of Median Number of Medications by Category vs. Age group and Gender



In the above plot, the median number of total medications and range was similar across both genders in the 65-74 year and 75-85 year age groups, but was lower for the younger age group. For men in the sample, the median number of prescription-only medications is higher at older ages, whereas it appears to be more stable for OTC and herbal and dietary supplements. For women in the sample, the median number of prescription only medications is similar for the 57-64 year and 65-74 year age groups, and is highest in the oldest group; OTC and dietary supplements appear to have similar variability across all age groups for both women and men, but there appears to be greater variability in use in women compared to men.

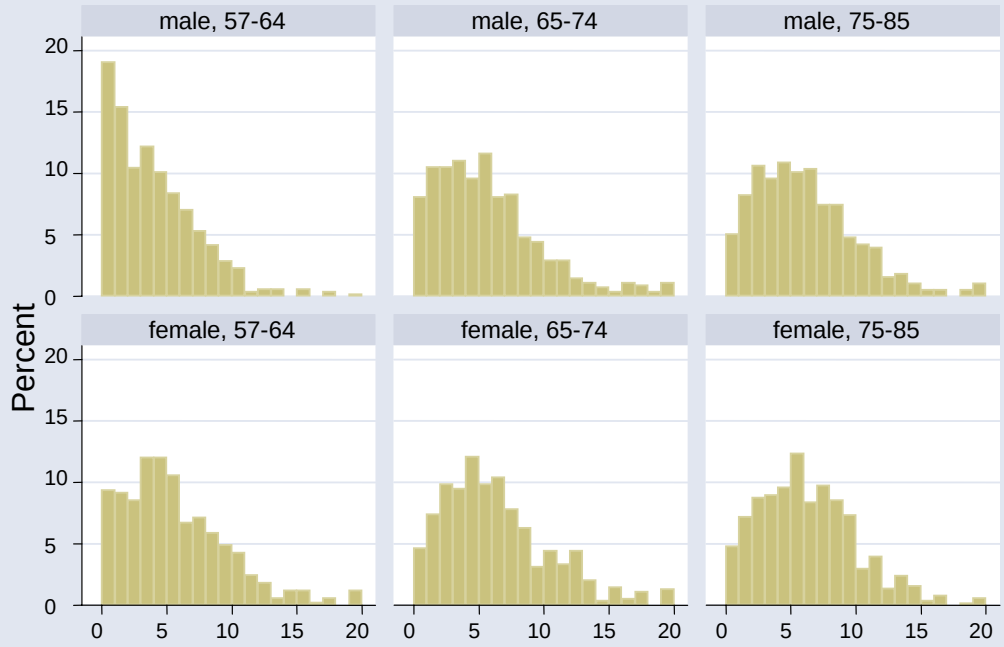


Figure 3: Percent Distribution of Total number of Medications per Respondent by Gender and Age group

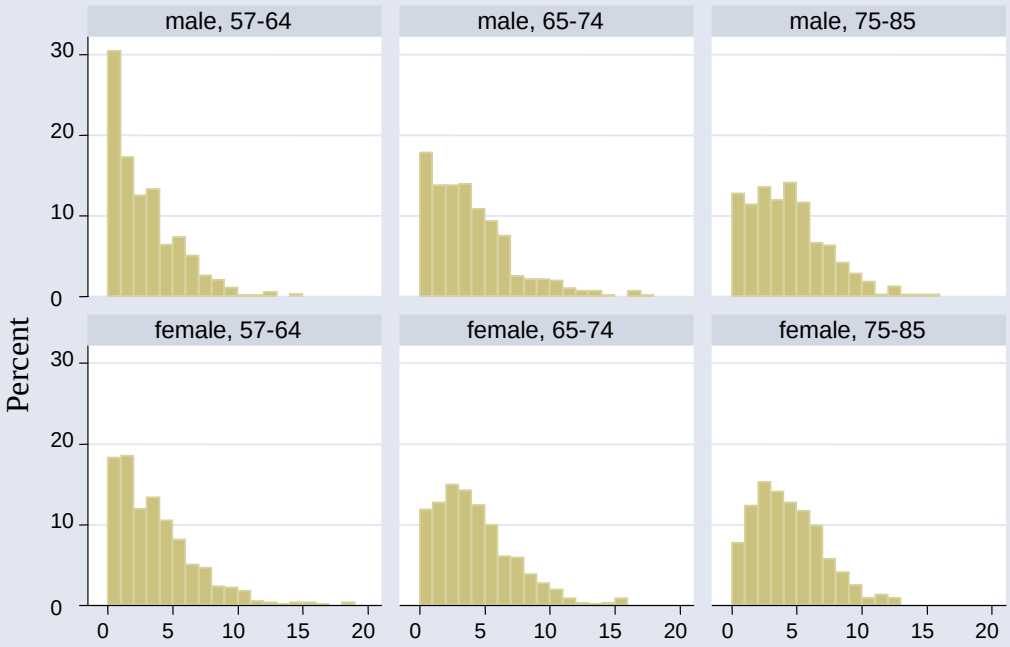


Figure 4: Percent Distribution of Total number of Prescription Only Medications per Respondent by Gender and Age group

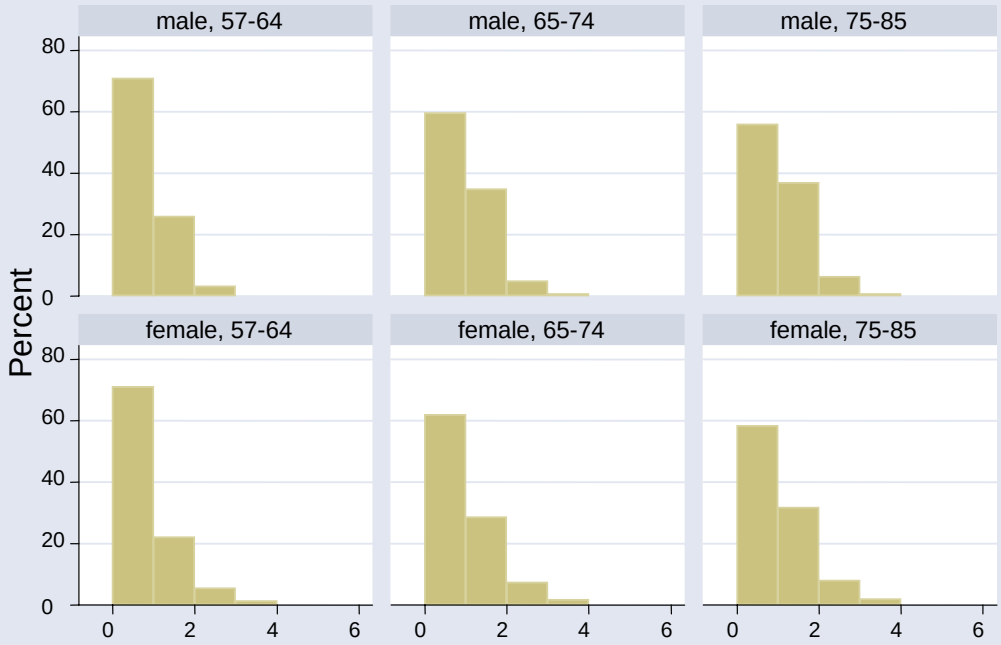


Figure 5: Percent Distribution of Total Number of OTC Medications
Per Respondent by Gender and Age group

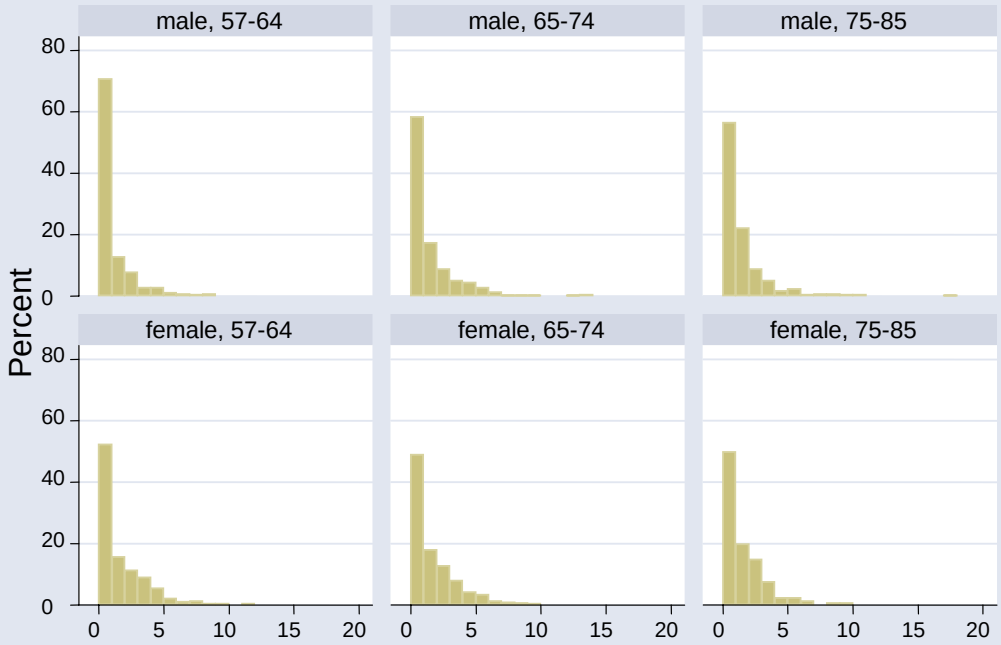


Figure 6: Percent Distribution of Total Number of Herbals/Dietary Supplements per
Respondent by Gender and Age group

1. Qato, D., Schumm, P., Lindau, S., *The National Social life, Health, and Aging Project Technical Report: An Overview of Medication Data Collected in Population-based Studies*. NORC and the University of Chicago, 2006.
2. StataCorp. 2005. Stata Statistical Software: Release 9. College Station, TX: StataCorp LP.
3. Microsoft Corp. Microsoft Excel software (2003 version). Redmond, WA.