Relationships among Cardiovascular Disease Risk, Dietary Supplement Use, and Attempted Weight Loss in the National Health and Nutrition Examination Survey (1999-2004)

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Presenter Disclosures

James W. Shaw

- The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No relationships to disclose

Background

- Dietary supplements (DSs) have been increasingly used for maintaining health and preventing illness.[1]
- Many DSs have been marketed and used for cardioprotective purposes.[2-3]
- Garlic, niacin, coenzyme Q10 (CoQ10), fish oil, and antioxidant vitamins are effective in preventing development of coronary heart disease (CHD).[4-6]

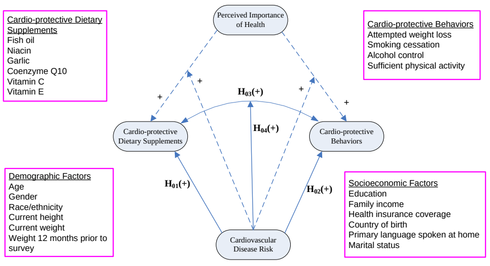
Background

- Numerous studies have been conducted to ascertain the determinants of DS use.[7-21]
  - Female gender, older age, higher education, non-Hispanic white race/ethnicity, higher physical activity, and normal or below-normal body weight have been associated with more frequent DS use.
- Relatively few studies have been based on a conceptual model of health behavior.[15-21]
- Most prospective studies have involved small, non-random samples, which limits the generality of their findings.

Objective

- To develop and test a conceptual model of cardioprotective DS (CDS) use and engagement in other cardioprotective behaviors (CBs) as a function of cardiovascular disease risk (CDR).

Conceptual Framework



Data Source

- Data taken from the 1999-2000, 2001-2002, and 2003-2004 waves of NHANES.
  - Stratified, multistage probability sample of US civilian noninstitutionalized population.
- Four components collect sociodemographic, physical examination, laboratory, and other self-reported information.
- A total of 31,126 individuals participated in the three survey waves.
- Excluding participants <20 years of age, the analytical sample consisted of 15,332 respondents representing 200,707,729 adult population members.

CDR Classification

Class	Criteria
Diseased	Self-reported history of CHD, angina, and/or myocardial infarction.
At-risk	Self-reported diagnosis of hyperlipidemia, hypertension, diabetes mellitus, or any combination of these three risk factors but no history of CHD.
Low risk	No self-reported diagnosis of hyperlipidemia, hypertension, diabetes mellitus, CHD, angina, or myocardial infarction.

CDS Use

- Reported use of single-ingredient DSs containing niacin, CoQ10, fish oil, garlic, vitamin C, or vitamin E during the month prior to survey.
- These six CDSs were selected because of the evidence supporting their efficacy for preventing and treating cardiovascular disease as well as their high prevalence of use in published studies involving CHD patients.[2,22-23]

Other CB Participation

- Several CBs—including attempted weight loss (AWL) , smoking cessation, alcohol consumption, and physical activity—were targeted for analysis. However, adequate measures for the latter three behaviors were not available in the NHANES data.
- AWL was measured as the report of any attempt to lose weight or the loss of ≥10 lb. that was intentional during the preceding 12 months.

Sampling Design Considerations

- All statistical analyses accounted for the complex sampling design of NHANES.
- Probability weights were recalibrated to refer to an estimate of the US adult population total at the midpoint of the time horizon.

Missing Data

- Missing data for all variables were imputed using multivariate imputation by chained equations.[24]
- Ten complete data sets were produced for analysis.
- Statistical analyses were performed in each data set after which conventional multiple imputation methods were applied to combine the estimates to produce a single inference.[25]

Model Fitting and Testing

- A path model was developed to describe the relationships among CDS use, AWL, and CDR. Path coefficients were estimated using bivariate probit regression.
  - H_{01} and H_{02} were evaluated by performing a joint test of the parameter estimates for the at-risk and diseased groups in the equations for CDS use and AWL, respectively.
  - H_{03} was evaluated by testing correlation between errors in predicting CDS use and AWL.
  - To evaluate H_{04}, the sample was stratified by CDR, and the model was fitted separately within each stratum. Estimates for the fitted models were combined to form a simultaneous covariance matrix that was used to test whether the correlation between the errors in predicting CDS use and AWL increased with CDR risk.

Model Fitting and Testing

- Current height and weight, weight 12 months prior to survey, age, gender, race/ethnicity, education, family income, marital status, health insurance, country of birth, primary language, and survey year were treated as potential confounders.
- Marginal effects (MEs) were derived to relate path coefficient estimates to changes in the predicted probability of CDS use or AWL.

Results

Descriptive Statistics: CDR
Population Percentage (Mean Sample n)

Characteristic	Total (n = 15,332)	1999-2002 (n = 10,291)	2003-2004 (n = 5,041)	p-value
CDR				0.006
Diseased	6.30 (1,306)	6.11 (835)	6.68 (471)	
At-risk	36.96 (6,049)	35.42 (3,928)	39.94 (2,121)	
Low-risk	56.74 (7,977)	58.48 (5,528)	53.38 (2,449)	

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Descriptive Statistics: CDS Use and AWL
Population Percentage (Mean Sample n)

Characteristic	Total (n = 15,332)	1999-2002 (n = 10,291)	2003-2004 (n = 5,041)	p-value
CDS use, yes				
Any	18.15 (2,458)	18.19 (1,613)	18.08 (845)	0.950
Vitamin E	11.84 (1,676)	12.22 (1,131)	11.10 (545)	0.347
Vitamin C	11.10 (1,417)	10.71 (898)	11.85 (519)	0.365
Garlic	1.25 (179)	1.31 (122)	1.14 (57)	0.603
CoQ10	0.79 (88)	0.63 (53)	1.10 (35)	0.079
Niacin	0.39 (52)	0.43 (37)	0.31 (15)	0.492
Fish oil	0.07 (9)	0.07 (5)	0.07 (4)	0.987
AWL, yes	39.38 (5,442)	37.55 (3,521)	42.91 (1,921)	<0.001

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Association of CDS Use with AWL and CDR
Population Percentage (Mean Sample n)

Characteristic	CDS Users (n = 2,458)	CDS Nonusers (n = 12,874)	p-value
AWL, yes	43.25 (966)	38.52 (4,476)	0.001
CDR			<0.001
Diseased	9.19 (295)	5.66 (1,011)	
At-risk	47.67 (1,241)	34.58 (4,808)	
Low-risk	43.15 (922)	59.75 (7,055)	

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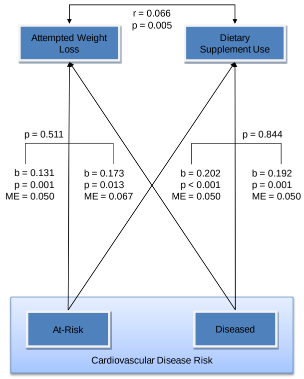
Path Model Estimates



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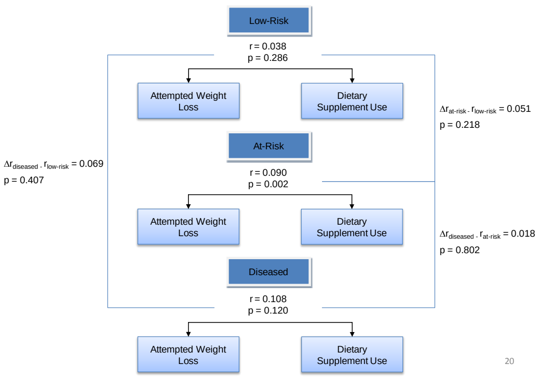
Variation in CDS Use/AWL Association with CDR



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Other Findings

- CDS use was positively associated with current height (p=0.001), age (p<0.001), female gender (p=0.001), level of education (p<0.001), and health insurance coverage (p=0.003).
- Non-Hispanic blacks were less likely to use CDSs than non-Hispanic whites (p<0.001).
- Persons with an annual income less than $20,000 were less likely to use CDSs than those having an annual income between $35,000 and $54,999 (p=0.018).

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Discussion

- Most of the hypothesized relationships were affirmed.
- Failure to detect a moderating effect of CDR on the CDS use/AWL association may have been due to inadequate power caused by unequal CDR group sizes or variation induced by sample weighting.
- CDR may serve as a warning sign that triggers individuals to engage in behaviors thought to improve cardiovascular health. However, once cardiovascular disease develops, these individuals may be reluctant to increase their level of behavioral participation due to a perceived lack of benefit.

Limitations

- Limitations of NHANES data
  - All data were collected via self-report. Findings subject to recall bias.
  - The prevalence of CDS use was underestimated to some degree due to exclusion of multi-ingredient DSs.
  - No information regarding date of diagnosis for conditions used to define CDR.
- Misclassification bias
  - Different classification of CDR or of any of the covariates included in the fitted models could have affected results.

Conclusions

- CDS users are more likely to engage in CBs than CDS nonusers.
- CDS use and CB participation increase when health is impaired.
- Our findings provide general support for a conceptual model developed to explain the association between CDS use and CB participation.
- This study serves as an example of how conceptually driven behavioral research can be performed using secondary data from population health surveys.

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