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Authors

Betz, Marian

Hill, Linda

Fowler, Nicole

et al.

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"Is it time to stop driving?": A Randomized Clinical Trial of an Online Decision Aid for Older Drivers

Marian E. Betz, MD, MPH[a,b], **Linda L. Hill, MD, MPH**[c], **Nicole R. Fowler, PhD, MHSA**[d,e], **Carolyn DiGuiseppi, MD, MPH, PhD**[f], **S. Duke Han, PhD**[g], **Rachel L. Johnson, MS**[h], **Lauren Meador, MPH**[a], **Faris Omeragic, BS**[a], **Ryan A. Peterson, PhD**[h], **Daniel D. Matlock, MD, MPH**[b,i]

[a.]Department of Emergency Medicine, University of Colorado, School of Medicine, Aurora, CO

[b.]VA Eastern Colorado Geriatric Research Education and Clinical Center, Rocky Mountain Regional VA Medical Center, Aurora, CO

[c.]School of Public Health, University of California San Diego, San Diego, CA

[d.]Department of Medicine, Indiana University School of Medicine, Indianapolis, IN

[e.]Indiana University Center for Aging Research, Indianapolis, IN

[f.]Department of Epidemiology, Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO

[g.]Department of Family Medicine, Keck School of Medicine of the University of Southern California, Los Angeles, CA

[h.]Department of Biostatistics & Informatics, Colorado School of Public Health, Aurora, CO

[i.]Division of Geriatric Medicine, University of Colorado, School of Medicine, Aurora, CO

Abstract

Background: Many older adults face the difficult decision of when to stop driving. We sought to test whether an online driving decision aid (DDA) would improve decision quality.

Methods: This prospective two-arm randomized trial enrolled English-speaking licensed drivers (age ≥70 years) without significant cognitive impairment but with ≥1 diagnosis associated with increased likelihood of driving cessation); all participants received primary care in clinics associated with study sites in three states. The intervention was the online Healthwise® DDA for older adults addressing "Is it time to stop driving?"; control was web-based information for older drivers only. The primary outcome was decision conflict as estimated by the Decisional Conflict Scale (DCS; lower scores indicate higher quality). Secondary outcomes were knowledge

Corresponding author: Marian Betz; Marian.betz@cuanschutz.edu; (303) 550-5669; Twitter @EmmyBetz, 12401 E 17th Ave B-215; Aurora, CO 80045.

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and decision self-efficacy about driving decisions. We examined post-randomization differences in primary and secondary outcomes by study arm using generalized linear mixed-effects models with adjustment for site and pre-randomization scores.

Results: Among 301 participants (mean age: 77.1 years), 51.2% identified as female and the majority as non-Hispanic (99.0%) and White (95.3%); 98.0% lived in an urban area. Participant characteristics were similar by study arm but differed across sites. Intervention participants had a lower mean DCS score (12.3 DDA vs 15.2 control; adjusted mean ratio [AMR] 0.76, 95%CI 0.61–0.95; p=0.017). Intervention participants had higher mean knowledge scores (88.9 DDA vs 79.9 control; OR 1.13, 95%CI 1.01–1.27, p=0.038); there was no difference between groups in self-efficacy scores. The DDA had high acceptability; 86.9% of those who viewed it said they would recommend it to others in similar situations.

Conclusions: The online Healthwise® DDA decreased decision conflict and increased knowledge in this sample of English-speaking, older adults without significant cognitive impairment, although most chose to continue driving. Use of such resources in clinical or community settings may support older adults as they transition from driving to other forms of mobility.

Trial Registration: ClinicalTrials.gov identifier “Advancing Understanding of Transportation Options (AUTO)” NCT04141891.

Keywords

Decision-making; Driving; Motor vehicle; Randomized trial; Geriatric; Decision aid

INTRODUCTION

The decision to reduce or cease driving is often difficult and stressful for older adults, their families, and their healthcare providers. There are over 45 million licensed older drivers in the US,[1] yet older adults generally outlive safe driving ability by 7–10 years.[2] As a result, many older adults and their family members are faced with the decision of if and when to stop driving, and how to stay mobile afterwards. Driving has a clear relationship to health and perceived independence and well-being. Although crash risk rises with age,[4] driving and maintaining independence are closely linked, and driving cessation can negatively impact a person’s health and psychosocial well-being.[3–6]

Decision-making about driving cessation is complicated by the nature of driving risk (impacted by myriad cognitive and physical conditions[7,8]), varying support for individuals after driving retirement (including emotional support and usable alternative transportation), and strong emotions about driving. Older adults want to maintain control of driving decisions and have time to prepare for mobility transitions.[9–11] Family members want to discuss driving with their loved ones and are often uncertain of how and when to do so, especially since these discussions are not routine in primary care.[9,12,13] The challenge of how to support older adults making decisions about driving[14–16] gains urgency with the aging population and a growing number of older adults living with physical and cognitive impairment.

Although informational websites and self-assessment tools exist, a key knowledge gap has been how to help older drivers actually make decisions about their driving in a way that is individualized and supports autonomy. In clinical medicine, decision aids are used to increase patient knowledge and decision quality.[17] An existing web-accessible driving decision aid (DDA)[18] meets international decision aid standards[19] but has not yet been tested for efficacy.

The Advancing Understanding of Transportation Options (AUTO)[20] study is a multi-site, two-armed randomized controlled trial testing the impact of a DDA on older adults' decisions about changes in driving behaviors and cessation. AUTO was designed to enroll 300 community-dwelling older drivers, each with a study partner identified by each driver. Dyads were randomized to view a DDA or control (web-based information only[21]), and the trial seeks to examine arm differences on decision conflict, knowledge, and self-efficacy, hypothesizing that DDA participants will have higher quality decisions (as approximated by lower internal conflict, higher knowledge, and higher self-efficacy).[22]

METHODS

Study Design

AUTO is a randomized, controlled trial of older drivers, with methods described in detail elsewhere.[20] The trial was designed to assess the effect of the Healthwise® DDA[18] on immediate outcomes (as reported here) and over two years of longitudinal follow-up. The underlying hypothesis is that the DDA will improve decision quality concerning driving behaviors, which will mitigate subsequent negative psychosocial impacts related to driving reduction or cessation. The study follows Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) Guidelines[23] and Standards for UNiversal reporting of patient Decision Aid Evaluation studies (SUNDAE checklist).[24] It was approved by the institutional review boards of study sites (University of California San Diego, University of Colorado, and Indiana University), and is registered with clinicaltrials.gov (NCT04141891). The study is monitored by an independent Data and Safety and Monitoring Board. Healthwise® made the DDA available at no cost to study participants but did not have any other involvement in study design, conduct, analysis or interpretation.

Participants

AUTO sought to enroll dyads formed by (1) older drivers (age ≥70 years, goal n=300) and (2) study partners (family member, friend, or other individual whom the patient identifies as someone who might be involved in decision-making about driving or in providing support for the transition to nondriving; n=up to 300). This analysis of the primary study outcome focuses only on older drivers. Additional eligibility criteria for older adults included: receiving primary care through healthcare systems in San Diego, California, Denver, Colorado, or Indianapolis, Indiana; being fluent in English (as DDA is only available in English); being able and willing to complete telephone follow-up calls; driving at least weekly with a valid driver's license; reporting no major changes to health, vision, or hearing that seriously impair driving since last license renewal; and not feeling the DMV would have serious concerns about driving. Because the study examines decision-making about

driving cessation, older adults had to have at least one electronic health record (EHR) diagnosis of a progressive condition associated with reduced driving ability and increased risk of cessation (as defined by the study team; examples include macular degeneration, diabetic retinopathy, congestive heart failure, Parkinson disease, vertigo, arthritis and foot abnormalities, and sleep apnea).[20] Individuals were ineligible if they were already enrolled in the LongROAD study (a longitudinal observational study of older drivers),[25] were in legal custody or institutionalized, or had a 5-minute Montreal Cognitive Assessment (MoCA) score < 21.

Setting and Procedures

Potential participants were identified by EHR review of patients affiliated with primary care clinics at the study sites, mailed opt-out letters, and then contacted by telephone by study staff. Individuals deemed eligible after telephone screening were offered enrollment in the study; initially, baseline visits occurred in person (December, 2019 to March, 2020), but all study activities were conducted remotely after the COVID-19 pandemic began (May, 2020, to June, 2021). Informed consent was obtained from all participants at the baseline study encounter. Participants were randomized to DDA or control (1:1 ratio) in blocks of 4 and 6[26] using a centralized, computer-generated list. Participants were blinded to their allocation, though all knew the study is about driving. The research assistant administering the questionnaires was blinded until the point of randomization; a second individual at a different physical location, and blinded to participant responses, performed the randomization. They notified the research assistant, who then showed or emailed the participant the appropriate website (DDA or control). The study statistician was blinded to arm allocation.

Intervention

The intervention, an online decision aid for older adults addressing the decision, “Is it time to stop driving?,”[18] has six sections: “Get the Facts,” “Compare Options,” “Your Feelings,” “Your Decision,” “Quiz Yourself,” and “Your Summary.” The DDA is in greyscale without videos or images and presents two ultimate options (“Stop driving” or “Keep driving”) along with their respective benefits and risks. The “Your Decision” prompts participants to rate (on a 7-point Likert scale) their current plan, from “1-leaning toward stopping driving” to “7-leaning toward keeping driving.”

Control

The control was the National Institute on Aging “Older Drivers” website,[27] chosen because it represents easily- and freely-accessible information about driving. Unlike the DDA, the NIA website does not provide guidance through the process of decision-making, although it does include a personal story from an older driver and general information about medical conditions and alternative transportation. Like the DDA, it has no videos. Control participations were also administered the “Your Decision” question described above.

Data Collection

At the baseline visit, study staff administered questionnaires to participants and entered data directly into REDCap (Research Electronic Data Capture),[28] a secure online database. The baseline instrument included questions on demographics, perceived stress (Perceived Stress Scale Short-Form [PSS-4]), cognitive function (MoCA), global, mental, emotional and social health (Patient-Reported Outcomes Measurement Information System [PROMIS] measures), driving and use of other transportation. Mobility measures included the Life-Space Assessment instrument,[29] with composite scores ranging from 0 (bedbound) to 120 (travel out of town every day without assistance),[30] as well as questions about driving behaviors and attitudes. AUTO participants complete telephone follow-up visits at 6, 12, 18 and 24 months; this analysis included the primary measures only from the baseline visit.

Outcomes

The primary outcome was decision conflict immediately after exposure to the intervention or control as measured by the Decisional Conflict Scale (DCS).[31] The Ottawa Decision Support Framework[32] states that low decision conflict (i.e., low personal uncertainty or ambivalence about a decision) is a marker of higher decision quality; a high-quality decision, which is one that is informed and aligned with personal values, is associated with subsequent action and improved health outcomes. The 16-item DCS has three subscales and in previous work discriminated between known groups who make or delay decisions.[31,33,34] Scores range from 0 (extremely clear) to 100 (extremely unclear about personal values); in prior work, total scores < 25 (out of 100 total) were associated with implementing decisions.[31] In a 2017 systematic review and metanalysis of studies comparing a decision aid to a control, the DA group had a lower absolute DCS score (7.22 out of 100; 95%CI 5.31–9.12).[33]

A secondary outcome was knowledge about driving decisions immediately after exposure to the intervention or control, measured as proportion of questions answered correctly on a 5-item test assessing concepts presented in the DDA and control website. An additional secondary immediate outcome was self-efficacy or belief in their ability to make decisions about driving, as measured on the Decision Self-Efficacy Scale;[35] scores range from 0 (extremely low) to 100 (extremely high) self-efficacy.

Sample Size

A target sample size of 150 participants per study arm (goal n=300 total) was chosen to allow detection of a 20–40% difference between the arms for the primary outcome (DCS score < 25)[31] at a power of 90% and a 0.05 significance level and allowing for 10% loss to follow-up for longitudinal outcomes. Recruitment and randomization were stratified by site, with a goal of n=100 per site (split in a 1:1 ratio between intervention and control at each site).

Analysis

Demographics were summarized at baseline for drivers overall, by study arm, and by site. Differences between groups were tested with two-sample t tests or one way-ANOVAs, as

appropriate, for continuous demographic variables and Fisher's exact tests for categorical variables, due to small sample size in some cells.

Mixed-effect models were used to test whether post-randomization outcomes differed by group; these models were adjusted for baseline (pre-randomization) outcomes and included a random intercept for site, since there were significant differences in participant characteristics by site. Binary outcomes were modeled with generalized linear mixed-effects models with a logit link. Since continuous outcomes were all skewed, model fit was compared for each of these outcomes with normal, Poisson, and negative binomial distributions, and the best model fit for each outcome was determined by which had the lowest Akaike's Information Criterion (AIC).[36] Therefore, which direction participants were leaning on the DCS was modeled with a normal distribution, other continuous DCS outcomes were modeled with a negative binomial distribution, and self-efficacy and knowledge were modeled with a Poisson distribution. All analyses were performed in R version 4.0.5.[37]

RESULTS

Between December 2019 and June 2021, 301 older drivers were enrolled at the three sites (100 or 101 per site). Participants were randomized equally at sites to intervention (n=151; 50 or 51 per site) or control (n=150, 50 per site; Figure 1; Table 1). Mean participant age was 77.1 years (SD, 5.1; range 70–92); half (51.2%) identified as female and the majority as non-Hispanic (99.0%) and White (95.3%). Approximately half (46.5%) had a post-graduate degree. Nearly two thirds were married or partnered (62.7%) and lived with a spouse or partner (60.5%); almost all lived in a private residence (92.0%) in an urban area (98.0%). Across characteristics, there were no significant differences by study arm (Table 1). There were differences across sites in level of education and employment, marital and residence status (Supplementary Table S1), so analyses were adjusted for site.

Effect of the Intervention on Decision Outcomes

For the primary outcome of DCS score, there was no evidence of a difference in the proportion of individuals with a DCS score lower than 25 by study arm after adjustment (73.8% DDA vs 68.9% control; adjusted odds ratio [AOR] 1.11, 95%CI 0.61–2.03; p=0.734). However, after viewing the control or DDA, those in the DDA intervention group had a 24% lower adjusted mean overall DCS score vs control (12.3 vs 15.2; adjusted mean ratio [AMR] 0.76, 95%CI 0.61–0.95; p=0.017) in negative binominal regression with a random intercept and adjustment for site and pre-randomization score (Figure 2).

Mean knowledge scores after the intervention were significantly higher in the DDA group than control (88.9 vs 79.9), including after adjustment for site and pre-randomization scores (AMR 1.13, 95%CI 1.01–1.27, p=0.038; Figure 3). Mean self-efficacy scores, however, did not vary between study arms (93.2 DDA vs 92.9 control; AMR 0.99, 95%CI 0.94–1.04, p=0.642; Figure 4).

Intervention Acceptability

Participants in the DDA arm were asked about the tool's acceptability; the majority said it was the right length (79.6%), had the right amount of information (79.6%), and was balanced between stopping vs continuing driving (74.8%). Almost all said the tool was respectful of personal values (97.2%) and presented realistic options (91.8%); 97.3% said it was at least somewhat helpful and 86.9% said they would recommend it to someone in a similar situation.

DISCUSSION

In this large, multi-site randomized trial of older drivers, exposure to an online decision aid was associated with reduced decision conflict and increased knowledge about driving decisions. The tool had high acceptability, with nearly all participants saying they would recommend it to others. For older adults, the decision to reduce or cease driving can be difficult and emotional,[9] and this study suggests online decision support may ease the process.

The AUTO study enrolled older adults who were currently driving but had at least one medical condition potentially associated with driving cessation; however, active contemplation of cessation was not an eligibility criterion, as the study will follow individuals for two years. Participants had relative low Decision Conflict Scale scores even before being randomized to the decision aid or control, suggesting they had low ambivalence about whether to stop driving. The finding that scores were nevertheless reduced in the intervention group is therefore notable, with future work needed to see the effect in individuals with higher initial internal conflict (i.e., those actively considering driving cessation). While conflict was statistically lower in the intervention group, it is not yet clear if this difference of 24% is clinically meaningful in terms of reduced psychosocial distress over time; longitudinal analyses from AUTO should help answer this question. Longitudinal analyses will also examine driving and safety outcomes, including reported driving behaviors and crashes.

This study examined DDA developed by Healthwise®, a nonprofit organization that creates health education tools for a wide range of health topics. Healthwise tools have been disseminated and used in a variety of settings including hospitals and other healthcare settings across the United States. Prior work has reinforced the important role for primary care providers, occupational therapists, and other clinicians in helping older adults make decisions about driving,[9,12,38,39] as part of a broad, multi-modal approach to supporting older adults and their families.[40]

At the time of the study, the DDA was only available in English, but future testing in non-English-speaking populations will be important. A driving decision aid for older adults with dementia has been developed and pilot tested in English in Australia[41] and in Mandarin in Taiwan;[42] it has also been translated into Italian, Greek, and Vietnamese.[43] In pilot testing, it had high acceptability but its effects on decision outcomes are unknown.

LIMITATIONS

The study population was predominantly highly educated, urban, White, Non-Hispanic individuals, so our results may not generalize to other populations. In rural areas, older adults may have very different risks and benefits to consider, given a dearth of usable alternative transportation. Similarly, older adults with lower socioeconomic status may not have the resources to use paid alternatives like ride share services. Study research assistants were unblinded after randomization, as they had to show the participant the correct study materials (intervention vs control), raising the question of bias. However, participants were enrolled at three sites with multiple study staff, all of whom had been trained to administer questionnaires with neutral, non-leading language, and all analysis was blinded; these make systematic influence on results less likely, though not impossible. The decision aid was only available in English at the time of the study, so participation was limited to individuals who could read and speak English. The COVID-19 pandemic, which was ongoing during study enrollment, may affect older adult driving behaviors, but intervention and control participants were similar in reported changes to driving due to COVID-19. Finally, the low initial ambivalence about driving cessation in this group may limit generalizability; further work in populations actively considering cessation is needed.

CONCLUSIONS

The Healthwise® Driving Decision Aid[18] reduces decision conflict and increases knowledge in older drivers. Dissemination and use of resources like this in clinical and community settings may support older adults as they transition from driving and thereby potentially mitigate the negative psychosocial effects of driving cessation.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

- Many older adults, and their families and providers, must decide whether and when to stop driving.
- An online decision aid seeks to guide individuals through this decision by providing facts, helping clarify values and preferences, and presenting options with their benefits and drawbacks.
- In a randomized controlled trial, older adults who viewed the decision aid (versus an educational web site) had lower decisional conflict and higher knowledge about whether to stop or continue driving.

Why does this matter?

This online decision aid may help older adults with the difficult, emotional decision about driving cessation and thereby prevent negative psychosocial health outcomes.

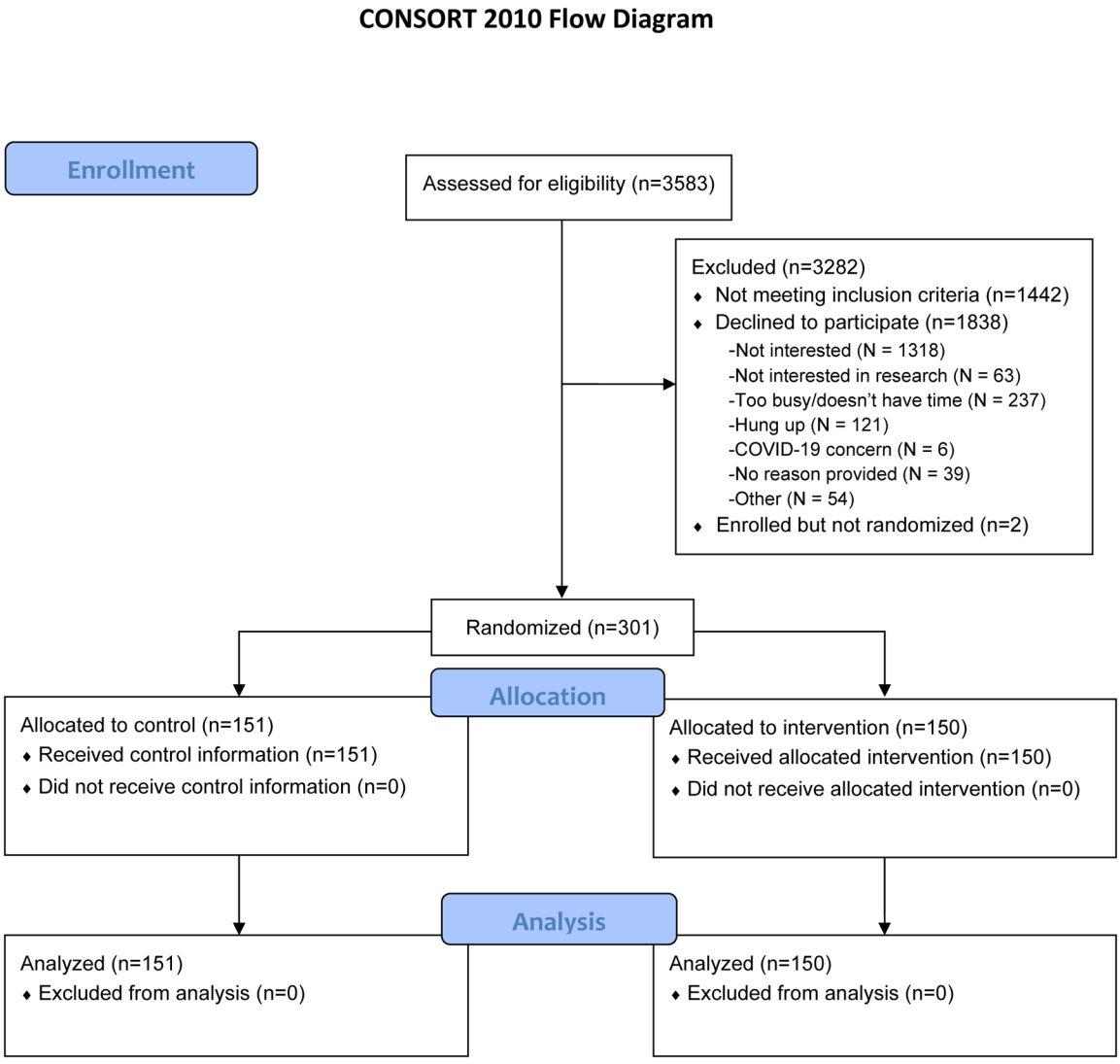

Figure 1.
CONSORT Flow Diagram

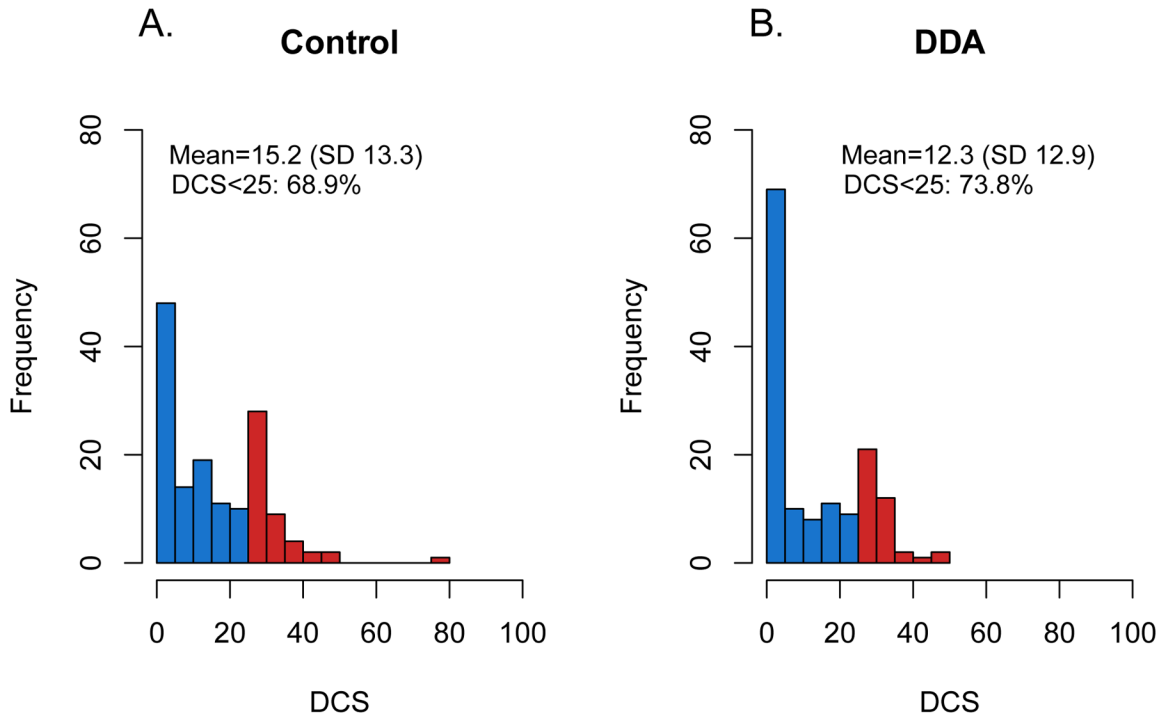

Figure 2.

Post-randomization participant DCS scores, by study arm (n=301). Scores<25 are shown in blue.

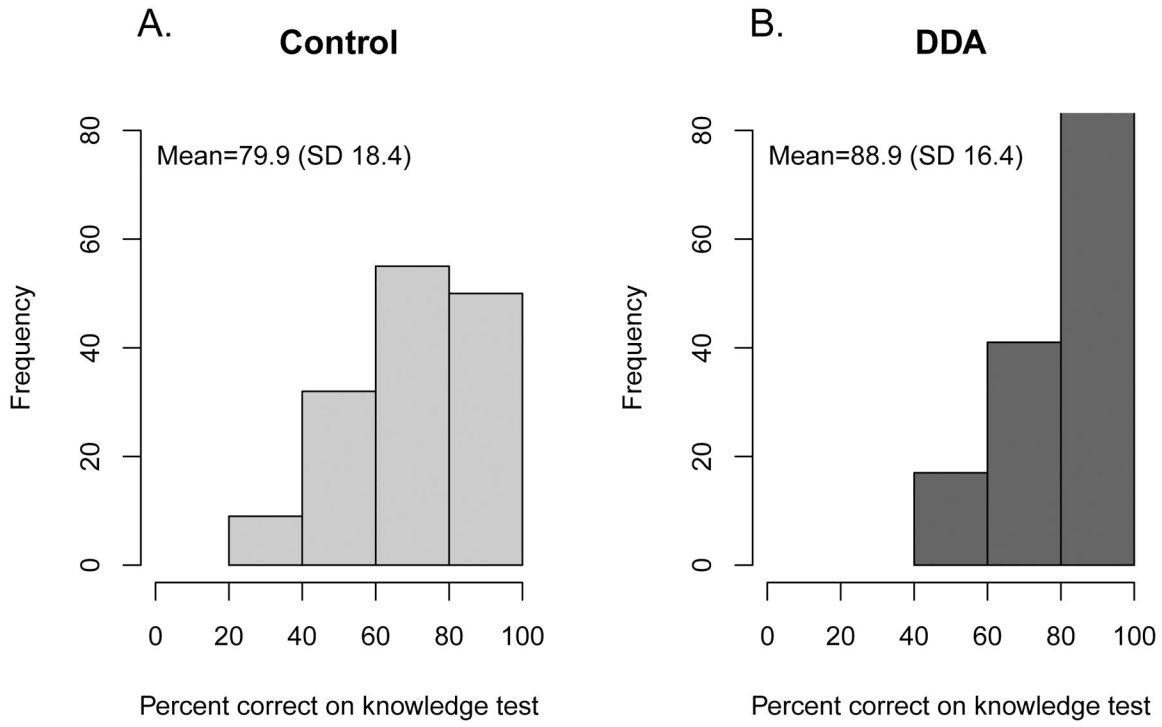

Figure 3.

Post-randomization participant scores on knowledge of driving decisions test, by study arm (n=301)

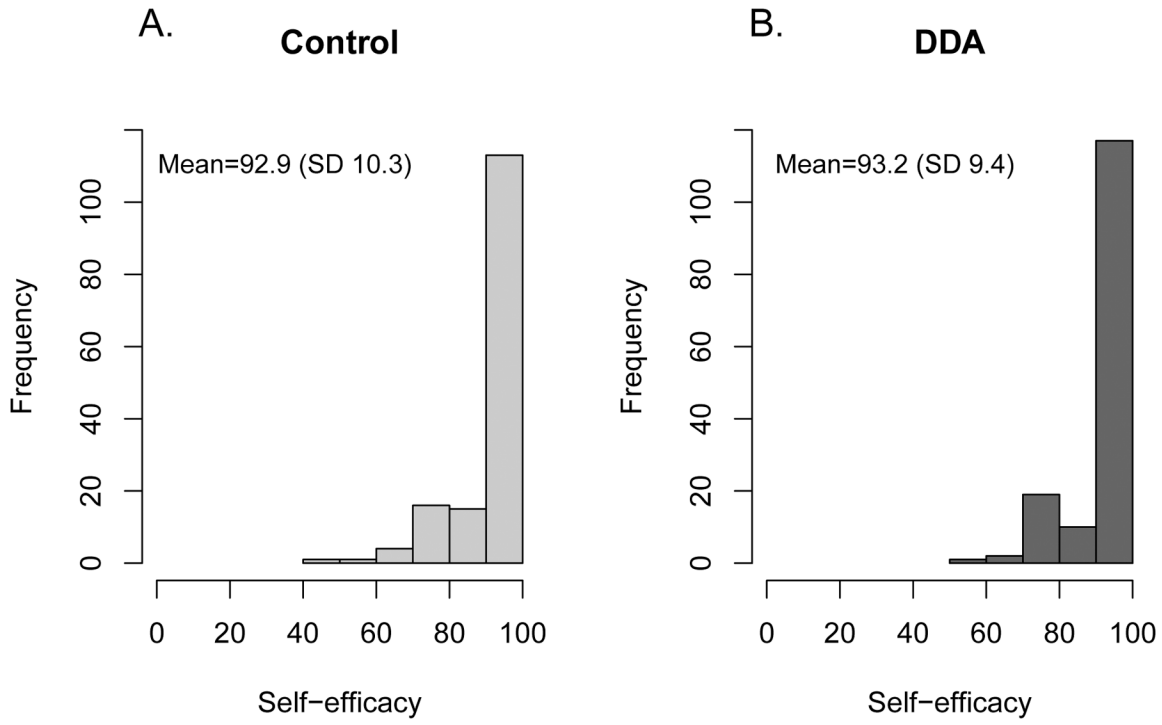

Figure 4.

Post-randomization participant self-efficacy about driving decisions scores, by study arm (n=301)

Table 1.

Participant Characteristics, by study arm (N=301)

	All (N = 301)		Control (N = 151)		DDA (N = 150)		
Demographics	**N or mean**	**% or SD**	**N or mean**	**% or SD**	**N or mean**	**% or SD**	**p value**
Age (years)	77.1	5.1	76.7	5.2	77.5	5.0	0.163
Male gender (self-identified)[a]	147	48.8	76	50.3	71	47.3	0.645
Race[a]							0.628
White	283	95.3	142	94.7	141	95.9	
Black or African American	6	2.0	3	2.0	3	2.0	
Asian	3	1.0	1	0.7	2	1.4	
Other	5	1.7	4	2.7	1	0.7	
Hispanic ethnicity	3	1.0	3	2.0	0	0	0.247
Highest grade completed							0.347
≤ High school graduate	27	9.0	12	7.9	15	10.0	
Some college/vocational/tech	65	21.6	27	17.9	38	25.3	
College graduate	69	22.9	36	23.8	33	22.0	
Any post-graduate work (masters, doctorate)	140	46.5	76	50.3	64	42.7	
Employment status							0.242
Employed full time	17	5.6	10	6.6	7	4.7	
Employed part time	28	9.3	18	11.9	10	6.7	
No paid employment	7	2.3	2	1.3	5	3.3	
Retired	249	82.7	121	80.1	128	85.3	
Currently married/partnered	188	62.7	97	64.2	91	61.1	0.633
Currently lives:							
Alone	99	33.1	47	31.1	52	35.1	0.539
In private home or apartment	277	92.0	138	91.4	139	92.7	0.832
Rural-Urban designation[b]							0.212
Urban	292	98.0	148	98.7	144	97.3	
Suburban	5	1.7	1	0.7	4	2.7	
Rural	1	0.3	1	0.7	0	0	
Physical and mental health							
MoCA score (5-minute telephone screener)	25.6	2.2	25.3	2.2	25.8	2.4	0.217
PROMIS global health							
Physical subscale t score	49.7	7.6	49.2	7.7	50.1	7.5	0.333
Mental subscale t score	53.1	6.5	52.9	6.7	53.4	6.4	0.550
PROMIS emotional support (4a) T score	55.3	6.8	55.7	7.0	54.9	6.6	0.331
PROMIS social isolation (4a) T score	46.2	6.4	46.2	6.2	46.3	6.5	0.881
PROMIS depression (4a) T score	46.2	6.4	46.1	6.3	46.3	6.4	0.810
Perceived stress scale short-form (PSS-4)	5.4	2.4	5.6	2.6	5.3	2.2	0.226
Driving and mobility							

	All (N = 301)		Control (N = 151)		DDA (N = 150)		
Demographics	**N or mean**	**% or SD**	**N or mean**	**% or SD**	**N or mean**	**% or SD**	**p value**
Life space total score[c]	76.1	19.7	75.2	20.6	76.9	18.7	0.452
Last drove a car							0.603
0–7 days ago	230	95.8	115	95.0	115	96.6	
8–14 days ago	5	2.1	2	1.7	3	2.5	
>14 days ago	5	2.1	4	3.3	1	0.8	
During the past 3 months, has driven:							
To places beyond neighborhood	294	98.0	145	96.7	149	99.3	0.214
To neighboring towns	276	91.7	138	91.4	138	92.0	1
To more distant towns	145	48.2	72	47.7	73	48.7	0.908
To places outside the state	41	13.6	24	15.9	17	11.3	0.313
To places outside the USA	3	1.0	1	0.7	2	1.3	1
During the past 3 months, has used following to get around:							
Public bus	12	4.0	6	4.0	6	4.0	1
Local tram/train/subway	19	6.3	10	6.6	9	6.0	1
Rideshare services like Lyft or Uber	39	13.0	20	13.3	19	12.7	1
Taxi (other than Lyft/Uber)	10	3.3	3	2.0	7	4.7	0.218
Special community transportation (ex: Dial-A-Ride)	3	1.0	0	0	3	2.0	0.247
Ride with friend/family member as passenger	250	83.1	126	83.4	124	82.7	0.879
Other volunteer driver	4	1.3	2	1.3	2	1.3	1
Other	6	2.0	2	1.3	4	2.7	0.446
During the past 6 months, has reduced amount of driving in any way	183	61.0	90	60.0	93	62.0	0.813
During the past 3 months, has altered driving patterns because of COVID-19	134	56.1	70	58.3	64	53.8	0.516
Leaning towards stopping vs continuing driving[d]	6.7	0.8	6.6	0.9	6.7	0.8	0.222
Pre-randomization scores on outcome measures							
Decisional Conflict Scale score < 25 (binary)	188	66.0	90	63.4	98	68.5	0.383
Decisional Conflict Scale total score (continuous)	17.9	12.4	18.5	12.4	17.3	12.5	0.415
Knowledge of driving decisions	74.9	20.2	75.9	20.4	73.9	19.9	0.411
Self-efficacy about driving decisions	91.3	10.0	90.7	10.7	92	9.3	0.269

Abbreviations: MoCA - Montreal Cognitive Assessment. PROMIS - Patient-Reported Outcomes Measurement Information System

[a] These variables came from the participant's medical record, which allowed only binary gender (male or female) and only one race category.

[b] Rural-Urban Commuting Area (RUCA) codes based on home residence

[c] Lifespace scores of ≤60 are correlated with lower levels of social participation and higher mortality[44]

[d] Scale of 1 (leaning toward stopping driving) to 7 (leaning toward keeping driving)