Title page

Manuscript title: Driving habits and reaction times on a driving simulation in older drivers with chronic heart failure

Short title: Driving in chronic heart failure

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Abstract

Background: Judgement and reaction times during complex tasks like driving may be impaired in older adults with chronic heart failure (HF).

Objectives: This study sought to report the driving habits and reaction times of older patients with HF in a specially designed urban driving simulation.

Methods: We conducted a prospective observational study in HF patients and controls. Patients in both groups underwent cognitive testing and screening for depression. Current drivers undertook questionnaire regarding driving habits followed by an urban road driving simulation consisting of three laps. Five separate hazards appeared in the third lap without warning. Reaction times and stopping distances to the hazards were calculated.

Results: Of 247 patients with HF approached for the study, 124 had already voluntarily stopped driving due to HF (n=92) or other medical conditions (n=32), 60 had never had a license, and 32 declined to participate. Of the 74 controls approached, 1 was not currently driving due to a medical condition, and 46 declined to participate. Patients in both groups had similar levels of cognitive function, mood and driving habits. 30 patients with HF [mean (SD) age 74 (±5) years, median (IQR) NT-proBNP 1510 (546-3084) pg/L] and 26 controls [mean age 73 (±5) years, median NT-proBNP 135 (73-182) pg/L] completed the simulation. During lap 3, there was no difference in the driving speed between patients (mean 22.0 SD 4.5 mph) and controls (mean 21.7 SD3.3 mph; p=0.80). Patients had longer reaction times [median 1.10 (IQR 0.98-1.30) seconds) than controls [median 0.96 (IQR 0.83-1.10) seconds, p=0.02], but there was no difference in stopping distances [patients: median 43.9 (IQR 32.2- 49.5) metres; controls: median 38.1 (IQR 32.3-48.8) metres, p=0.31)].

Conclusions: Many older adults with HF no longer drive. Those who continue to drive appear safe to drive on simulated urban roads.

Key words: Driving, cognitive impairment, simulation

Introduction

Many cardiac illnesses predispose patients to cerebrovascular disease, potentially impairing their driving ability, making it less safe for the patient and other road users. Cognitive impairment is common in older people and is strongly associated with chronic heart failure (HF),[1] which may impair the ability of patients with HF to drive safely.[2] Although current European and American guidelines emphasise the importance of comorbidities that influence activities of daily living, they do not recommend restricting driving in patients with HF without severe symptoms at rest (New York Heart Association, NYHA class IV).[3,4]

In the United Kingdom (UK), the Driver & Vehicle Licensing Agency (DVLA) provides guidance on assessing fitness to drive in those with cardiovascular disease.[5] Only patients with NYHA class IV symptoms and those with devices in situ are obliged to stop driving. Temporary restrictions apply to those with life-threatening arrhythmias.

There is a literature on driving safety in patient receiving palliative care,[6] but very little is known about patients with HF. In particular, no studies have investigated reaction times to unexpected hazards, an important measure of safe driving ability and a routine part of the UK's driving licensing examinations.

We therefore investigated the driving habits and reaction times of patients with HF in comparison with age-matched controls using a previously validated driving habits questionnaire and a specially designed driving simulation. We hypothesised that patients with HF will have longer reaction times and stopping distances to on-road driving hazards, compared to controls.

Methods

Study subjects

This is a prospective cohort study conducted in an outpatient setting in Hull, UK between May and August 2017. We enrolled patients with and without HF who were at least 60 years old within 6 months of screening. Control subjects had to fulfil the following criteria:1) no previous or current symptoms or signs of HF; 2) left ventricular function better than, or equal to, mild-moderate systolic dysfunction or LVEF>45% on echocardiography. Many hadclinical risk factors for developing HF, including coronary artery disease, diabetes mellitus or hypertension because they are highly prevalent in the older population. From an initial survey population of 247 patients with HF, 31 took part in the driving simulation. We recruited 27 controls of similar age. We wanted patients to reflect those who were actively driving and therefore only included stable patients (no admission to hospital within the last month) with a valid UK driving license, who drove at least once a week. None had experience with commercial driving video games or simulations.

The North East Tyne & Wear South Research Ethics Committee approved the study protocol (REC Reference17/NE/0021). This study complies with the Declaration of Helsinki, and all patients gave signed consent. Two investigators (DP and CW) recruited and studied each participant.

Patient and public involvement statement

Patients helped to write a plan language summary and design a leaflet for dissemination to their peers and patient groups. Patients were also involved in the design of the driving simulation to ensure that it reflected the local environment. Control subjects had previously agreed to be approached for research studies. It was difficult to involve patients in other aspects of study design due to data protection restrictions and technical methods required for data analysis.

Protocol

All subjects were asked to complete the Patient Health Questionnaire-9 (PHQ-9) and Montreal Cognitive Assessment (MoCA) since major depression or previously undiagnosed severe cognitive impairment may have an impact on driving ability.[7,8] Patients' driving habits were then assessed with the Driving Habits Questionnaire (DHQ) before the driving simulation.

a) Patient Health Questionnaire – 9 (PHQ-9)

PHQ-9 is a self-administered survey used to identify depression.[9] Patients indicate the frequency with which they experienced the thoughts conveyed by nine statements. Each statement forms a component of the diagnostic criteria for depression, as defined by the Diagnostic and Statistical Manual of Mental Disorders. The answers are scored as 0= not at all, 1 = several days, 2 = more than half of days, 3 = nearly every day. A score of 5-9 is suggestive of mild depression; a score of ≥10 is diagnostic of major depression.[10]

b) Montreal Cognitive Assessment (MoCA)

The MoCA is a interviewer-administered questionnaire that assesses multiple areas of cognitive function. The MoCA has higher sensitivity in detecting cognitive deficits, including mild cognitive impairment, in comparison to other screens, such as the mini-mental state examination.[11] The original form of the MoCA (Version 7.1) was used.[12] Scores range from 0 to 30 points, with a lower score reflecting greater cognitive impairment. A score of

18-26 indicates mild cognitive impairment, 10-17 indicates moderate cognitive impairment and <10 indicates severe cognitive impairment.

c) Driving habits questionnaire (DHQ)

The driving habits questionnaire (DHQ)[13] is also interviewer-administered. It addresses six domains: current driving status and driving practices (seatbelt use, driving speed, self-assessment of quality of driving); driving exposure (average number of days driven per week, where the participant drives); dependence on other drivers (with whom the subject usually travels in a car); driving difficulty (how the subject drives in different driving situations); driving space (distance the subject typically drives); and self-reported accidents.[13] The DHQ's results are examined separately and cannot be used as a total score. The questionnaire's test-retest reliability is high[13] and it has been validated in previous studies investigating the driving habits of patients with chronic disease.[14–16] As the original questionnaire was designed for patients from America, minor modifications were made to make it suitable for UK participants (for example, using the word *motorway* instead of *highway*, turning *right* into oncoming traffic instead of *left*).

Driving simulation

A driving simulation was designed with the purpose of assessing reaction times. The hardware used was a standard computer with a graphics card on a 3440 X 1440 pixel, 34 inches wide screen monitor (LG 34UM95-P). Driving feedback was provided through visual, auditory and kinetic channels. Sound intensity, provided through a speaker stereo system, varied with acceleration, braking and movement relative to the road. The driving interface was a T500RS force feedback steering wheel and three-pedal set (Thrustmaster, Hillsboro, United States). The interface provides a slight opposing force through the steering wheel as it is turned.

The simulation was developed using the Unity game development platform and software language C# (Version 6.0, Redmond, United States). The programme allows the participant to accelerate in a simulated car up to 180 miles per hour (mph) or 288 kilometres per hour (kph), in a virtual environment consisting of a 3.5 km elliptical urban road with houses on both sides. On-screen visual features included pavements on either side as well as 25 road signs, 17 speed signs, 8 parked cars and 4 rubbish bins (Video 1). Houses, cars and other features used in the simulation were developed in 3D Studio Max (Version Autodesk 3ds Max 2016, Autodesk, Inc, Mill Vill, United States). All simulated features were developed from photographs of local features to imitate as closely as possible the local driving environment. There were no oncoming vehicles or pedestrians. Speed limit signs showed a mandatory 30 mph zone (the usual urban speed limit in the UK).

Standardised instructions were given to each participant before the start of the simulation and at fixed points during the course. Participants were asked to complete three laps, identical in route, each lasting approximately 3 minutes. Participants were asked to drive as they would normally. No measurements were made for the first lap, which served as a “warm up” lap to allow the participant to get used to the controls, steering and braking systems. Measurements taken during the second lap were: the time taken to complete the lap (in seconds); mean speed (miles per hour); number of times the accelerator and brake were pressed; number of times the car drove off the road; and number of collisions with obstacles on the road or houses.

During the third lap, a sign asking the participant to make an emergency stop (to simulate a hazard) appeared at five fixed points during the course (Figure 1; Video 1). Before starting the simulation, the participants were informed that hazards would appear requiring them to stop. The following additional measurements were additionally recorded by the computer system for each hazard: the speed at which the participant was travelling when the hazard appeared; the time taken from the appearance of the hazard to initiation of breaking (reaction time); the time taken from the appearance of the hazard to the vehicle coming to a stop (stopping time); and the time taken to press the accelerator again after stopping (restarting time). Reaction and stopping distances were calculated.

Statistical analysis

Descriptive statistics were used to characterize the demographics, prevalence of driving habits and driving simulation results in the HF and control groups. The independent *t*-test was used for continuous data (normality of distribution and homogeneity of variance), Fisher's exact test (less than five observations in each cell) or Pearson's chi-squared test (at least five observations in each cell) were used for nominal data and the Mann-Whitney U-test was used for non-parametric data to examine differences between patients and controls. Statistical analysis was performed using STATA version 14.2 (StataCorp, Texas, United States) and Excel version 2016 (Microsoft, Redmond, United States). A p value of 5% was considered statistically significant. Continuous variables with a normal distribution will be displayed as mean and standard deviation (SD), whilst continuous variables with a non-parametric distribution will be displayed as median and interquartile range (IQR)

Results

Patient recruitment and characteristics

The flow of patients through the study is shown in Figure 2. Of the 247 patients with HF approached, 216 (87%) were excluded, most commonly because they had already voluntarily stopped driving due to symptoms they attributed to heart failure (92 patients, 37%). Another quarter (60, 24%) of patients had never had a driving license. No patients had any medical devices in situ (Cardiac-resynchronisation therapy, implantable cardiac defibrillator or left ventricular assist device) None were on long term oxygen therapy at home.

Of the 74 controls who were approached, 46 declined to participate in the study with no reason given, and only one had voluntarily stopped driving for a medical condition. No participant in the control group cited never having a driving license as the reason for not driving.

One participant from each group withdrew from the study – one in the HF group gave no reason, and one in the control group withdrew due to nausea during the driving simulation.

Table 1 shows demographic data. Of the patients with HF, 77% had NYHA Class I or II symptoms. None was breathless at rest. Most had moderate or severe left ventricular systolic dysfunction; and only 2 had heart failure with normal ejection fraction. Patients in the control group were similar in age and sex distribution but had a lower prevalence of atrial fibrillation.

There was no difference in the PHQ-9 and MoCA scores between HF participants and controls. Two patients and two controls had a MoCA score <26, but none had moderate cognitive impairment (<17). Three patients and one control had a PHQ-9 score suggestive of depression. Patients reported consuming less alcohol per week than controls.

Driving Habits Questionnaire

The results of the driving habits questionnaire are shown in table 2. There was no difference between the groups in driving habits and no one reported having had a car crash in the previous year. Those with HF who continued to drive seemed to drive just as often, and as geographically wide as those without HF.

Simulation

Table 3 shows the results from lap 2 and 3 of the simulation. There was no difference in the time taken to complete the lap (and hence the mean speed) between the two groups. There were no collisions in either group. A few participants in both groups had an average speed that exceeded the speed limit of 30mph, but there were no significant differences in the number between groups.

Table 4 shows the variables measured during lap 3 of the simulation, when hazards appeared. The mean speed when hazards appeared was similar in the two groups, but patients with HF had slightly longer reaction times. Reaction times were significantly longer in patients with HF (by around 0.5-1.5 milliseconds) in all but the first hazard (Figure 3). Stopping times and stopping distances did not differ between groups. Amongst patients with HF, reaction times and stopping distances did not differ by NYHA classification.

Discussion

We found that many patients with HF stop driving by choice. Compared to age-matched controls, patients with HF who continue to drive took longer to react to a hazard that appeared suddenly during our driving simulation. This longer reaction time however did not translate into longer stopping distances. Since the speed of travel did not differ between patients and controls, this may imply that the HF group were able to brake harder than the control group.

Driving is a complex skill requiring intact visual, motor and cognitive functions. Cognitive deficits are common in patients with CHF[1,17–19], a long history of hypertension,[20] prior stroke, or cerebral hypoperfusion, due to low cardiac output and hypotension, may lead to functional and structural brain alterations, which could in turn affect reaction time. Poor sleeping habits,[21] anxiety and depression[22] are also common in patients with HF and may further affect concentration a key component in safe driving.

In a different driving simulation which lasted longer (30 minutes) and involved driving in a variety of environments, Alosco and colleagues found that poor physical fitness and reduced cognitive function secondary to HF were associated with more collisions and stop signs missed.[23] We deliberately set out to model the typical driving environment of older patients undertaking short trips in an urban environment that might mimic activities daily life (such as a trip to go shopping or visit friends) and found all patients in our study to be fit to drive.

Although the simulation was well received, tests were conducted in a research environment. Driving simulator tasks are correlated with on-road performance,[24,25] but we cannot know how the performances on our specific simulation match actual driving abilities on the road.

Therefore, our results require confirmation in further studies and should be interpreted with caution. There is no consensus on how to determine fitness to drive for patients with HF. Even in patients after ischaemic stroke, where is a large literature regarding driving, there is considerable variability in the results of cognitive, on-road and simulator-based assessments.[26] For most patients, neurocognitive testing combined with a road-test might be considered to be current best practise in determining safety to drive, although this would be a major undertaking if applied to patients with HF.[6]

Interestingly, the majority of patients with HF whom we approached for the study had already stopped driving, confirming previous findings. In the ACTIVE trial,[27] HF was a significant risk factor for driving cessation amongst 1,656 older adults over a 5- year period. Sims and colleagues studied 5,383 community-dwelling drivers aged 65 years or over, and also found that HF was an independent risk factor for driving cessation.[28] However, the decision for patients with HF to stop driving is complex, and external factors, such as pressure from close family members or changes in circumstances (e.g., occupation or retirement), are likely to have a significant influence.

Limitations

The sample size is small, but comparable to previous studies looking at driving in patients with chronic diseases.[14–16] Our study included only patients who drive at least once a week and the population is thus self-selecting. Consequently, our patients had relatively mild HF. Although our control group did not have HF, many had risk factors for cerebrovascular disease. This may limit the ability to find comparisons with the study group. Reaction times may have been different in elderly individuals completely free of cardiovascular disease, but such a ‘healthy’ age-matched control group in the UK is rare. Similarly, reaction times may have been different in younger individuals with HF or those with a more sever degree of cognitive impairment. We did not formally assess the patients’ visual fields, which has an impact on driving ability. Reaction times and stopping times may be different in patients who continue to drive with severe HF.

This was a pilot study with simple outcome measurements. Our simulation was relatively straightforward, with good weather conditions and low speed. Future studies could focus on two things. Firstly it may be useful to investigate more complex traffic scenarios reflective of ‘real life’, with higher road speeds, weather changes and increased visual clutter, all of which would increase demand on driving attention, assessed using more subtle measurements of driving function, such as deviation from the centre of the road whilst driving. Secondly, one could compare clinical and simulation differences between those with HF who drive and those who have stopped; this may create a blueprint of factors associated with driving cessation, and alert clinicians to certain qualities that may trigger fitness to driving evaluations, or a conversation for driving retirement in those outliers who may drive dangerously.

Conclusion

Older adults with HF who regularly drive have slightly longer reaction times than controls, but did not have any markers of dangerous driving in a driving simulation mimicking local driving.

Acknowledgements

The authors would like to thank staff at the Academic Cardiology department in Castle Hill Hospital, including James Illingworth, without which the setup of this study would not be possible. No authors declare any conflicts of interest.

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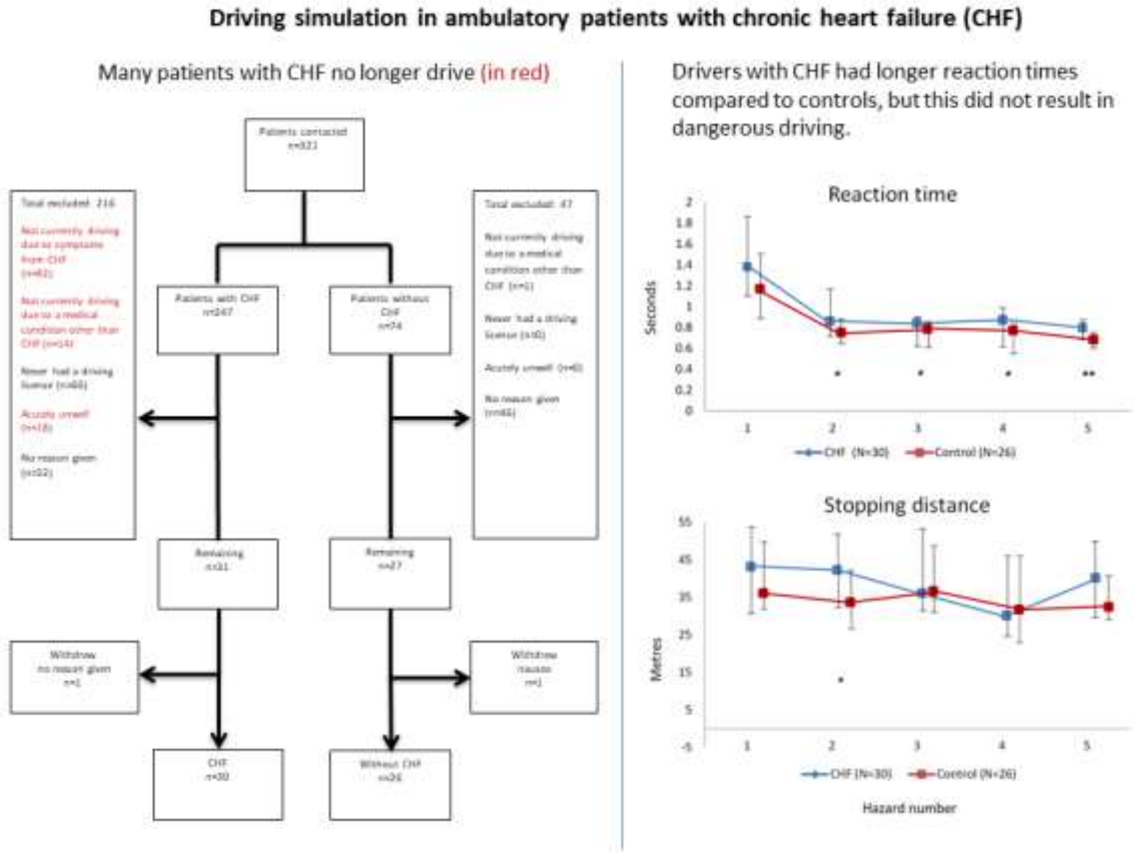
Figure legend



Graphical abstract: Many patients with HF have already stopped driving. Patients with HF who continued to drive had slower reaction times on an urban driving simulation. However, this did not translate into any markers of dangerous driving.

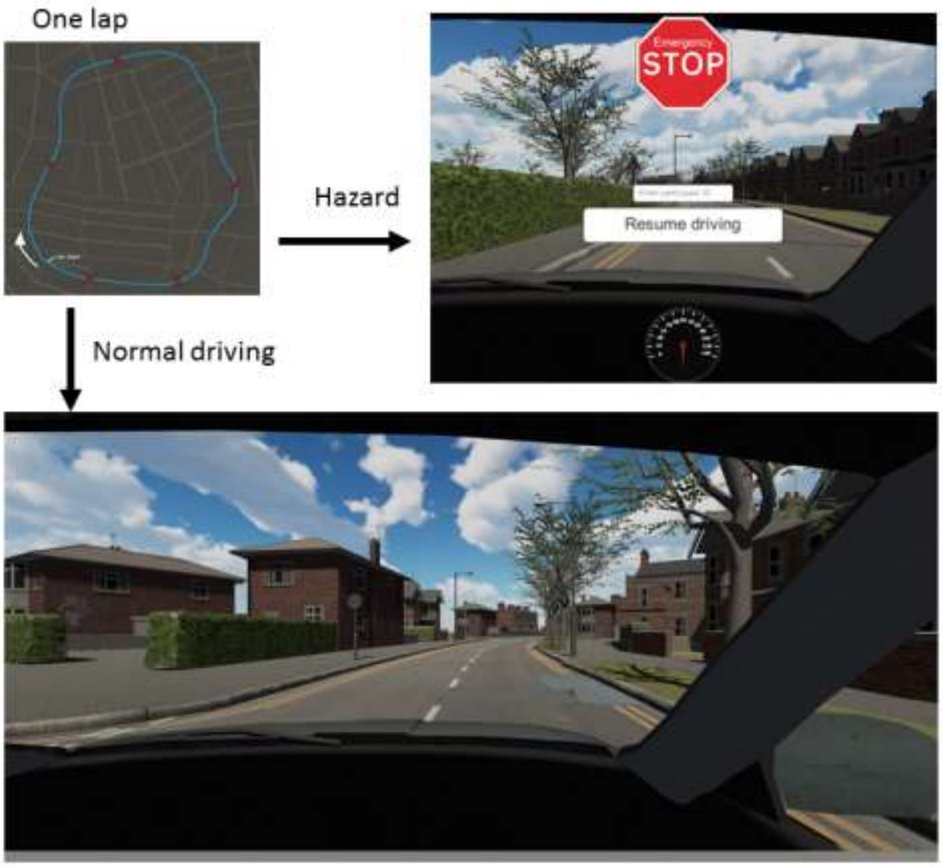


Figure 1: Photographs of the simulation during normal driving conditions (bottom panel) and when the emergency hazard appears (top, on the right). On the top left, a map shows the course for one lap, with 'X's marking points where the hazards will appear during the third lad. The participant cannot see this map.

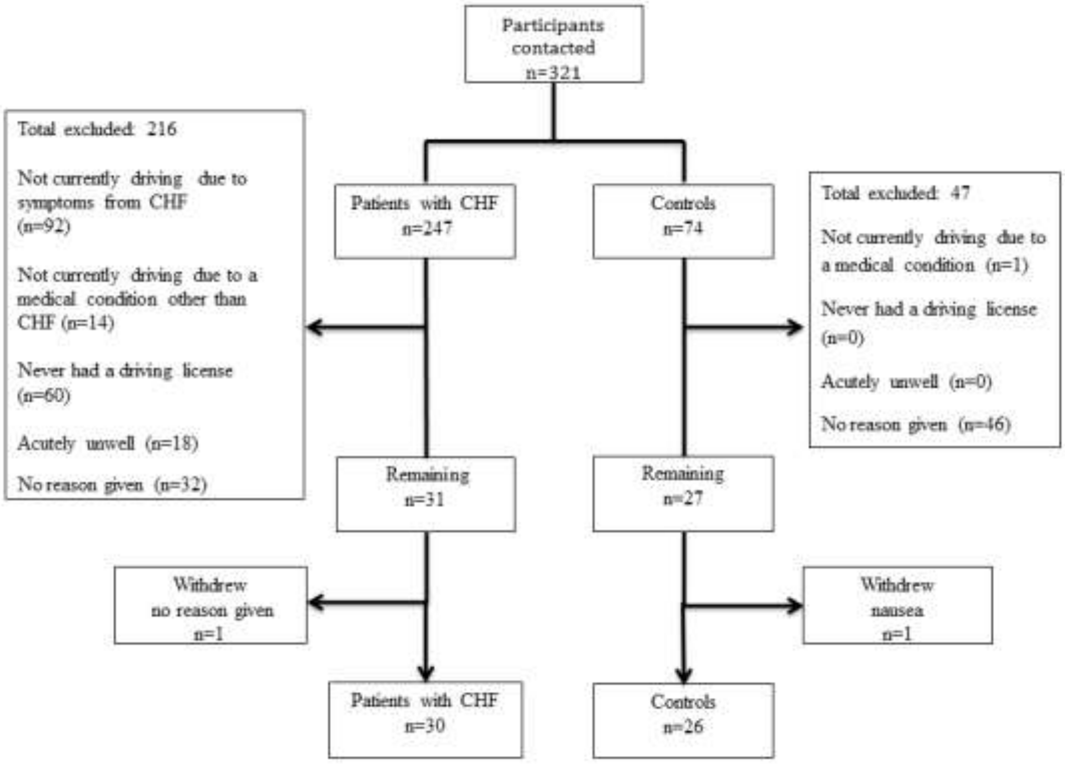


Figure 2: Flowchart of participants through the study.

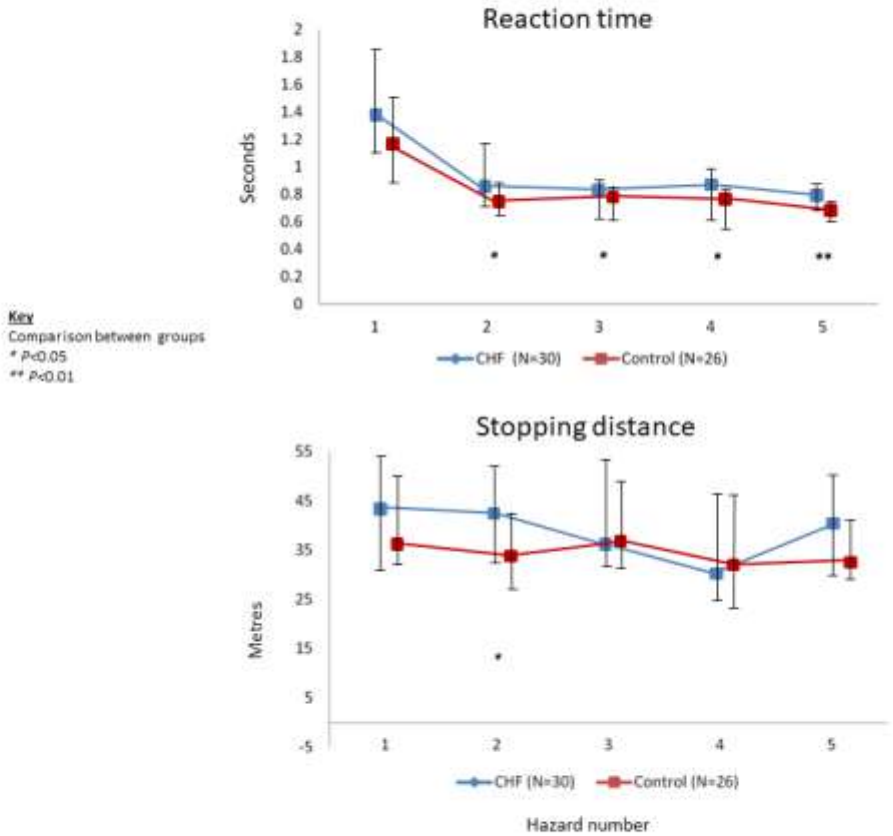


Figure 3: Line charts illustrating the trend of reaction times and stopping distances between patients with chronic heart failure and controls. *P* values were calculated using the Kruskall-Wallis test; * is a *p* value<0.05, ** is a *p* value<0.01.

Video legend

Video 1: A demonstration of the driving simulation. Hazards appeared in the third lap, requiring the participant to press the brakes until the vehicle comes to a stop.

Table legend

Variables	CHF (N=30)	Controls (N=26)	*P* value
Demographics			
Age (years)	74 ± 5	73±5	0.32
Males – n.(%)	27 (90)	23 (88)	0.58
Comorbidities			
Hypertension – n.(%)	14 (47)	15 (56)	0.11
Ischaemic Heart Disease – n.(%)	11 (37)	15 (56)	0.42
Myocardial Infarction – n.(%)	4 (13)	2 97)	0.18
Type 2 Diabetes – n. (%)	9 (30)	6 (22)	0.25
Stroke/Transient Ischaemic Attack – n. (%)	3 (10)	1 (4)	0.07
Peripheral Vascular Disease – n. (%)	5 (17)	5 (19)	0.24
Atrial Fibrillation – n. (%)	14 (47)	2 (7)	0.02
Hyperlipidaemia – n. (%)	16 (53)	10 (37)	0.27
COPD – n. (%)	4 (13)	2 (7)	0.18
NYHA Class – n. (%)			
Class I	6 (20)	-	NA
Class II	17 (57)	-	NA
Class III	7 (23)	-	NA
MoCA score	28.34 ± 1.71	28.53 ± 2.88	0.33
MoCA score: 17- 26	2 (7)	2(8)	1.00
PHQ-9 score	1 (0-3)	0 (0-1)	0.21
PHQ-9 score ≥5 (number of people)	3 (10)	1 (4)	0.62
Alcohol consumption units/week	1 (0 -3)	6 (0-16)	0.02
Heart rate prior to simulation - bpm	69 (12)	68 (11)	0.66
PR-interval on ECG - ms	190(29)	164 (26)	0.01
QRS duration on ECG - ms	108 (98-148)	88 (82-98)	0.001
Left ventricular systolic dysfunction on echo – n. (%)			
None	2 (7)	25 (96)	NA
Mild	0 (0)	1 (4)	
Moderate	15 (50)	0 (0)	
Severe	13 (43)	0 (0)	
Blood tests			
NT-proBNP – ng/L	1510 (546-3084)	135 (73-182)	0.001

Haemoglobin - g/L	135 (128-144)	141 (134-154)	0.17
Creatinine - µmol/L	115 (100-139)	83 (69-103)	0.005
Potassium - mmol/L	4.4 (4.1 – 4.6)	4.3 (4.0-4.6)	0.75
Sodium - mmol/L	136 (135 – 138)	138 (137-140)	0.65
Medications – n. (%)			
Beta-blocker	26 (87)	9 (35)	0.02
Digoxin	6 (20)	0 (0)	0.01
Statin	11 (37)	11 (42)	0.82
ACEI/ARB	26 (87)	7 (27)	0.01
MRA	13 (43)	0 (0)	0.01
Loop diuretics	28 (93)	0 (0)	0.01

Table 1: Characteristics of patients with chronic heart failure (HF) and controls

Questions	CHF (N=30)	Controls (N=26)	*P* value
What kind of car do you drive?			
Manual	23 (77)	20 (77)	0.26
Automatic	4 (13)	6 (23)	
Both	3 (10)	0 (0)	
Do you wear glasses/contact lenses when driving?			0.53
Yes	23 (77)	18 (69)	
No	7 (23)	8 (31)	
Do you wear seatbelt when driving?			
Always	28 (83)	25 (96)	1.00
Sometimes	0 (0)	0 (0)	
Never	2 (7)	1 (4)	
Preferred method of transport			
Public transportation/taxi	2 (7)	4 (15)	0.48
Have someone drive them	2 (7)	3 (12)	
Drive themselves	26 (87)	19 (73)	
Speed of driving compared to general flow of traffic			
Much slower	0 (0)	1(4)	0.48
Somewhat slower	2 (7)	4 (15)	
About the same	25 (83)	18 (69)	
Somewhat faster	2 (7)	3 (12)	
Much faster	1(3)	0 (0)	
Have been suggested to limit driving by family or friends			
Yes	1 (3)	2 (8)	0.59
No	29 (97)	24 (92)	

Rates the quality of their own driving			
Poor	1 (3)	0 (0)	0.06
Fair	2 (7)	2 (7)	
Average	1 (3)	7 (27)	
Above average	22 (73)	16 (62)	
Excellent	4 (13)	1 (4)	
If they had to go somewhere and didn't want to drive themselves, they would			
Ask a friend or relative to drive	14 (47)	11 (42)	0.82
Call a taxi/take a bus	12 (40)	12 (46)	
Drive regardless of how they felt	3 (10)	1 (4)	
Cancel/postpone plans and stay home	1 (3)	1(4)	
Other (walk/cycle)	0 (0)	1(4)	
Number of days per week a patient drives	6 (3-7)	6 (3-7)	0.74
Number of places travelled to per week	3 (2-3)	3 (2-3)	0.75
Number of total trips taken per week	7 (4-10)	5 (4-7)	0.13
Total number of miles driven per week	79 (4-131)	62 (36-131)	0.58
Total number of individuals they travel with per week	0(0-0)	0(0-1)	0.69
Total dependency score when travelling	1 (1-1)	1 (1-1)	0.88
Rating of driving in the following circumstances*			
Raining	1 (1-1)	1 (1-1)	0.93
Driving alone	1 (1-1)	1 (1-1)	0.97
Parallel parking	1 (1-1)	1 (1-1)	0.65
Right hand turns across oncoming traffic	1 (1-1)	1 (1-1)	0.85
Driven on motorways	1 (1-2)	1 (1-1)	0.36
High traffic roads	1 (1-1)	1 (1-1)	0.93
Driving in rush hour traffic	1 (1-1)	1 (1-1)	0.92
Driving at night	0 (0-0)	0 (0-0)	0.39
Number of accidents in the past year where they were the driver	0 (0-0)	0 (0-0)	NA
Number of accidents in past year when police where was called to the scene	0 (0-0)	0 (0-0)	NA
Number of times in the past year where they have been pulled over by the police regardless of whether they received a ticket	0 (0-0)	0 (0-0)	NA
Number of times in the past year where they received a traffic ticket other than a parking ticket	1 (1-1)	1(1-1)	NA
During the past year, driven to			
Immediate neighbourhood	30 (100)	26 (100)	NA
Beyond immediate neighbourhood	30 (100)	26 (100)	NA
Neighbouring cities	23 (77)	19 (73)	0.76
Distant towns/cities	10 (33)	10 (39)	0.69
Outside England	4 (13)	5 (19)	0.72

Table 2: Results from the driving habits questionnaire. *For driving in certain circumstances, 0 = No difficulty, 1 = Little difficulty, 2 = Moderately difficult, 3 = Extremely difficult

Variable	CHF (N=30)	Controls (N=26)	*P* value
Lap 2			
Time taken to complete lap in seconds	244.7 (230.4-282.5)	248.9 (229.9-280.7)	0.84
Mean speed/mph	25.9 (5.4)	25.2 (3.9)	0.59
Number of patients' mean speed >30mph	2 (7)	3 (12)	0.66
Number of times accelerator was pressed	9 (4-21)	10 (6-21)	0.69
Number of times brakes were pressed	0 (0-1)	0 (0-1)	0.65
Number of times car hit the pavement	0 (0-0)	0 (0-0)	NA
Collisions with obstacles or houses	0 (0-0)	0 (0-0)	NA
Lap 3			
Time taken to complete lap in seconds	287.0 (260.3-327.2)	286.5 (272.2-317.2)	0.77
Mean speed/mph	22.0 (4.5)	21.7 (3.3)	0.80
Number of patients' mean speed >30mph	1 (3)	0 (0)	1.00
Number of times accelerator was pressed	19 (11-31)	19 (10-29)	0.78
Number of times brakes were pressed	6 (5-7)	6 (5-6)	0.57
Number of times car hit the pavement	0 (0-0)	0 (0-0)	NA
Collisions with obstacles or houses	0 (0-0)	0 (0-0)	NA

Table 3: Summary of main findings from lap 2 and 3

Variable	CHF (N=30)	Controls (N=26)	*P* value
Speed travelling when hazard appears/mph –	26.6 (5.6)	25.5 (3.6)	0.43

mean (SD)			
Reaction time/seconds – median (IQR)	**1.10 (0.98 – 1.30)**	**0.96 (0.83-1.10)**	**0.02**
Stopping time/seconds – median (IQR)	3.46 (3.07-4.05)	3.25 (2.98-3.88)	0.23
Stopping distance/metres – median (IQR)	43.9 (32.2-49.5)	38.1 (32.3-48.8)	0.31
Restarting time/seconds – median (IQR)	2.29 (1.48-3.55)	1.65 (1.38-2.57)	0.08
Restarting distance/metres – median (IQR)	12.0 (10.1-18.5)	11.2 (9.5-13.2)	0.13

Table 4: Summary of additional findings from lap 3, when hazards appeared