­­­**Ischemia with No Obstructive Coronary Artery Disease (INOCA): A Patient Self-Report Quality of Life Survey from INOCA International**

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*The data underlying this article will be shared on reasonable request to the corresponding author.*

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Survey of @InocaInternati1 patients demonstrates onset of #INOCA symptoms associated w/ adverse physical, mental & social health QOL

1/3 lived w/ symptoms ≥3y before INOCA dx, 8/10 told symptoms not cardiac

Functional capacity higher prior vs after symptom onset (8.6 vs 5.6METs)

**Abbreviations and Acronyms:**

CAD = coronary artery disease

DASI= Duke Activity Status Index

INOCA= ischemia with no obstructive coronary arteries

METs= metabolic equivalents

**Abstract**

Background: There is limited information available regarding evidence of ischemia with no obstructive coronary arteries (INOCA) and quality of life.

Purpose: To determine associations between INOCA and self-reported physical, social, and mental health.

Methods: We conducted a survey of all members (n=1579) of the INOCA International patient support group. Current self-reported diagnosis and health measures were collected. Functional capacity was retrospectively estimated using the Duke Activity Status Index (DASI), assessing levels of activities performed prior and after symptom onset.

Results: A total of 297 (20.8% response rate, 91% women) reported symptoms of chest pain, pressure, or discomfort in 92.9%. Overall, 34.4% were living with symptoms for ≥3 years before an INOCA diagnosis, and 77.8% were told their symptoms were not cardiac. Estimated functional capacity was higher prior to compared to after symptom onset (8.6±1.8 METs vs 5.6±1.8 METs; P<0.0001). Most respondents reported an adverse impact of symptoms on their home life (80.5%), social life (80.1%), mental health (70.4%), outlook on life (69.7%), sex life (55.9%), and their partner/spouse relationship (53.9%), while approximately three-quarters reduced their work hours or stopped work completely, 47.5% retired early, and 38.4% applied for disability.

Conclusions: INOCA symptoms are associated with adverse physical, mental and social health quality of life. Increased patient awareness, physician recognition and diagnosis, and clinical trials are needed to develop evidence-based guidelines for this increasingly recognized cardiovascular disorder.

**Introduction:**

The diagnosis of coronary artery disease (CAD) has traditionally focused on the presence of obstructive CAD. Nonetheless, it is estimated that at least 2 in every 5 patients with angina referred for elective angiography have nonobstructive coronary arteries, with rates even higher in women.1, 2 Ischemia does not require the presence of obstructive coronary arteries,3 and this is recognized in the recent American Heart Association/American College of Cardiology chest pain guidelines expanding the definition of CAD to include both obstructive and nonobstructive CAD.4 These same guidelines included a diagnostic pathway for evaluation of chest pain for those with evidence of myocardial ischemia but no obstructive coronary arteries (INOCA).4

Patients with INOCA pose both a diagnostic and therapeutic challenge. Most patients with INOCA struggle for years to have an accurate diagnosis made, due to lack of physician awareness and limited availability of diagnostic testing and expertise in INOCA.5 In addition, the optimal medical management for INOCA is not well-defined, given that medical therapy should be directed based on the diagnosis of the underlying cause of ischemia, which is best defined by invasive vasoreactive testing but this is not routinely performed.6 As a result, patients with INOCA often live with protracted symptoms, undergo repeated diagnostic evaluations, and remain inadequately treated and inadequately diagnosed.2

To date, there is limited literature available on INOCA and quality of life. We sought to determine relations between INOCA symptoms and self-reported physical, social, and mental health. We hypothesized that all aspects of life could be adversely associated with INOCA symptoms.

**Methods:**

The survey was provided to all members of the patient support group from the United Kingdom (UK)-Based INOCA International, which is an international organization for persons living with INOCA. Awareness of the survey was released by a newsletter, as well as on Twitter and Facebook but only members of the patient support group could access the platform to receive a link for the survey. Participants could fill the survey only once from a single IP address. The survey collection began on October 27, 2021 and was closed on December 27, 2021.The survey questions are included in **Appendix 1**. All data collected was anonymized and answered directly through SurveyMonkey@TM. Approval for this survey was received from the Cedars-Sinai institutional review board.

Assessment of functional capacity was measured using the Duke Activity Status Index (DASI), previously validated in women with suspected INOCA.7 The survey assessed prior to and after the onset of symptoms. Functional capacity was calculated for each participant by converting the sum of DASI questionnaire scores to metabolic equivalents (METs) using the following formula: METs = 0.43 x DASI + 9.6 / 3.5, as previously described.8

The statistical analysis included descriptive and frequency distributions, with chi-squared statistics for categorical variable comparisons, and t-tests for continuous variable comparisons. Simple linear regression was performed to determine the association of days lost due to poor physical and mental health, and inability to perform recreational activities per month, related to functional capacity change after onset of symptoms. All statistical analyses were conducted via STATA (College Station, TX) statistical software.

**Results:**

Three hundred and twenty-eight respondents completed the survey. Given that the established membership of the patient support group of INOCA International is 1579, this represented a response rate of 20.8%. Thirty-one respondents reported not having INOCA, and by default could not answer any further questions in this survey and were excluded. Two hundred and ninety-seven respondents were finally included.

**Characteristics of Survey Respondents**

Most respondents were women (91.2%), which is slightly higher than the gender representation of the patient support group (83.3% women). The most common forms of diagnosis of INOCA in the responders were coronary microvascular dysfunction (64.3%) and coronary artery spasm (50.5%). Almost two-thirds were diagnosed between the ages of 40 to 60 years. A history of myocardial infarction was reported in 22.6%. A medical history of migraines was common (46.5%), as was a history of any adverse pregnancy outcomes (47.1%), with 25.2% having at least one miscarriage. (**Table 1**)

**Medical Evaluation for INOCA Symptoms**

Most respondents (40.4%) had experienced INOCA symptoms for at least 1 to 5 years, with almost half of them experiencing symptoms for anywhere between 1 to 10 years before the diagnosis of INOCA was made, and 77.8% who had been told their symptoms were not cardiac. The symptoms the respondents experienced were numerous, but 92.9% reported symptoms of chest pain, chest pressure, or chest discomfort, and 80.6% reported shortness of breath. Only 8.4% felt the ambulance crew understood the diagnosis of INOCA and 15.3% would not call the ambulance for their INOCA symptoms because they felt their symptoms were not taken seriously. The most common triggers of INOCA reported were stress (79.8%), exercise/exertion (73.4%), and excitement/high emotional state (69%). For the women who had undergone menopause, 37.5% reported that their symptoms changed with menopause. The majority (50.2%) had seen 3 or more cardiologists for the treatment of INOCA. Additionally, 31.6% had been referred to a psychiatrist for their symptoms and 42.1% had been prescribed an anti-depressant. Most respondents (53.9%) had been told their symptoms were due to gastroesophageal reflux disease, with 32% having undergone upper endoscopy for further evaluation. The majority of those surveyed reported that they were told that although their symptoms of INOCA may be unpleasant, they could not die from INOCA or have a heart attack (66.4%). Of the respondents who attended the emergency department for their symptoms, 69.4% were discharged without any treatment. (**Table 2**)

A minority (6.4%) were diagnosed with INOCA at the first consultation for the onset of symptoms. The majority (93.6%) reported multiple consultations before the diagnosis of INOCA was made. The majority (50.2%) also had consulted 3 or more cardiologists for the treatment of INOCA. All respondents underwent some diagnostic testing with non-invasive imaging performed in 93.3%, and 72.7% underwent invasive imaging but only 32.7% underwent cardiac catheterization with acetylcholine testing. Self-referral to a cardiology specialist familiar with INOCA was reported by 35.7% of individuals, and 38.4% reported never being under the care of an INOCA specialist. Of the respondents, 49.2% were currently under the care of a INOCA specialist (**Table 2)**.

**Associations with Health Quality of Life**

*General Health*: At the time of the survey, most of the respondents living with INOCA reported their health as being fair (32.7%) or poor (19.2%). (**Table 3)**

*Physical Health*: Prior to the onset of INOCA symptoms, the mean functional capacity for those surveyed was 8.6±1.8 METs, with 69.7% able to perform >8 METs. Following the onset of symptoms, the reported functional capacity was 5.6±1.8 METs, with only 11.4% able to perform >8 METs. (**Table 3, Table 4**). Those who reported poorer health had a lower functional capacity (data not shown). Those with a prior myocardial infarction had lower post-diagnosis functional capacity when compared with those without a myocardial infarction (5.5±1.8 METs vs 8.5±1.9 METs, respectively; p < 0.0001). Those with self-reported kidney disease had lower symptom onset functional capacity compared with those without kidney disease (4.6±1.0 METs vs. 5.7±1.9 METs; p = 0.031), and those with any co-morbidities had a lower post-symptom onset functional capacity than those with no co-morbidities. (6.1±1.9 METs vs. 5.4±1.8 METs; p = 0.0027).

*Social and Mental Health:* While living with INOCA, most of the respondents reported an adverse impact on their home life (80.5%), social life (80.1%), mental health (70.4%), outlook on life (69.7%), sex life (55.9%), and their partner/spouse relationship (53.9%). (**Table 3**) Those who reported an adverse impact of INOCA on specific aspects of their social and mental health had a significantly lower functional capacity compared to those who did not report any adverse impact of INOCA on those factors (**Figure 1**). Those who reported that their sex life was adversely affected the mean functional capacity level was lower than for those whose sex life was not adversely affected (5.1± 1.5 METs vs. 6.9± 1.9 METs; p<0.0001.

*Work and Disability:* Most respondents (69.0%) felt that there was an adverse impact on their work life while living with INOCA; and those who reported an adverse impact on their work life had a significantly lower mean functional capacity than those did not report any adverse impact on their work life (5.3±1.5 METs vs. 7.6±2.2 METs, respectively; p < 0.0001). After experiencing INOCA symptoms, approximately 3 of every 4 respondents had either reduced their work hours or had stopped work completely, 47.5% retired early, and 38.4% applied for disability (**Table 3**). Of those who applied for disability, 22.8% were unsuccessful at receiving disability benefits, with those who were successful having a lower functional capacity than those who were not (4.8±1.4 METs vs. 5.9±2.1 METs, respectively; p < 0.0001). Those who applied for disability, retired early or reduced working hours had a significantly lower functional capacity than those who did not (**Figure 2**).

*Living with INOCA Symptoms and Days of Declining Health:* After onset of symptoms, the respondents reported that for every 1 MET decrease in functional capacity, there was a loss of 3.0±0.6 days of physical health per month, 1.8±0.6 days of mental health per month, and 2.9 ±0.7 days of inability to perform recreational activities per month (p<0.0001) (**Figure 3**).

**Discussion:**

This study depicts adverse associations with many aspects of quality of life in INOCA patients. Patients reported that their physical, mental and social health were adversely impacted by INOCA symptoms indicative of reduced overall quality of life. Additionally, when compared to prior to the onset of INOCA symptoms, living with INOCA was associated with a significant reduction of approximately 3 METS of functional capacity, comparable to losing the ability to do light housework, activities of daily living (dressing, bathing, use the toilet independently), or being able to walk 1 block on level ground. Those who reported an adverse impact of INOCA on specific aspects of life had a relatively greater reduction in functional capacity, when compared with those who do not. These findings are unique, as there has been very limited data relating the patient experience of living with INOCA.

For the respondents of this survey, functional capacity was significantly reduced while living with INOCA when compared to prior to the onset of INOCA symptoms. Functional capacity is an established independent predictor of mortality,9 particularly when functional capacity falls below 5 METs,10 which in this surveyed population was the case for 5.1% prior to the onset of symptoms, but increased to 41.4% post-symptom onset. In the Women’s Ischemia Syndrome Evaluation (WISE) study, poor functional capacity in women with INOCA was associated with an adverse prognosis.11 A prior evaluation of registry studies demonstrated that patients with INOCA have relatively greater physical limitations and anginal frequency than patients with stable obstructive coronary artery disease and acute myocardial infarction survivors.12 This conflicts with findings from the WISE study, where functional capacity was demonstrated to be slightly greater in those women with nonobstructive CAD, when compared with obstructive CAD, using the DASI (5.0 METs±4.3 vs 5.6±4.7 METS, respectively; p=0.01).13 In this current INOCA survey, following symptom onset functional capacity was similar to what was seen in WISE (5.6 ±1.8 METs).13 Further, the survey demonstrates for the first time a decline in functional capacity associated with worsened aspects of physical, mental, and social health. Specifically, for every 1 MET reduction in functional capacity once experiencing INOCA symptoms, there was a self-reported 3-day loss in in physical health and ability to perform recreational physical activities per month, and 2 days per month with suboptimal mental health. The implication of poor functional capacity is important in understanding the impact of this disease and appreciating that the prognosis of INOCA is not benign.

Mental health was adversely impacted in 70.4% of those surveyed, with almost the same number reporting that INOCA had negatively affected their outlook on life. Psychological stress, which includes anxiety, depression, anger and personality disturbances, can be quite common in patients with CAD,14 including those with INOCA.15 It is estimated that the prevalence of depression is 15-30% in those with coronary heart disease, and highest post MI and in women,16 but it is unclear if these estimates included patients with nonobstructive CAD. The WISE study demonstrated that higher anxiety variables predicted more severe cardiac symptoms.17 In a previously reported study of 66 patients with INOCA, cardiac anxiety levels as assessed using the Cardiac Anxiety Questionnaire were significantly higher in INOCA patients when compared with prior assessments in patients with sudden cardiac death, and quite similar to those documented in patients with hypertrophic cardiomyopathy.12 Psychological stress can induce endothelial dysfunction and be an underlying cause of INOCA, particularly coronary microvascular dysfunction and vasospasm.18-20

The social health of patients was adversely impacted in those living with INOCA symptoms, with at least 4 of every 5 respondents reporting that their symptoms adversely affected their home life and social life. Sexual activity may often decrease after a myocardial infarction due to fears of inducing another myocardial infarction or anginal symptoms, as was demonstrated in a study of myocardial infarction survivors, where 47% of patient abstained or reduced their sexual activity after their myocardial infarction.21 This is comparable to the current survey results, where 1 in 2 patients reported that following onset of INOCA symptoms, their relationship with their partner/spouse and their sex life was adversely impacted. Providing counselling to patients regarding sexual activity after an acute myocardial infarction is far too infrequent,22 but for those with INOCA or myocardial infarction with no obstructive coronary arteries (MINOCA), it remains unknown what counselling is provided, if any. Based on the 2021 AHA Scientific Statement on sexual activity and CVD, “sexual activity is reasonable for patients who can exercise ≥ 3-5 METs without any angina, without angina, excessive dyspnea, ischemic ST-segment changes, cyanosis, hypotension, or arrhythmia.”23 In the current survey, 41.4% of the INOCA patients reported a functional capacity was <5 METs after onset of symptoms, and those who reported that their sex life was adversely impacted had a significantly lower functional capacity, compared with those whose sex life was not adversely affected.

We observed a significant association of living with INOCA symptoms on the ability to work, with almost 7 out of every 10 patients reporting that INOCA adversely affected their work life, resulting in more than half reducing their work hours or even retiring earlier than expected. Approximately one third of those surveyed changed their job or roles resulting in lower pay. Application for disability was also quite common in those living with INOCA. Our findings are consistent with a study of 66 patients where INOCA was assessed using cardiac magnetic resonance and demonstrated that patients with INOCA frequently missed work (1.1±2.2 full workdays missed in last 2 weeks) and had work limitations, suggestive of a substantial economic impact by work productivity loss.12 Nonetheless, this study did not address disability or changes in job or roles that also result in lower pay directly for the patient. A study from Denmark examined patients referred for coronary angiography for symptoms of stable angina, and demonstrated no difference in premature exit from the workforce or being on disability in those with obstructive and nonobstructive CAD.24 The national register from Sweden demonstrated that persons of working ages with ischemic heart disease took 83.9 days per year of disability leave in the first post-event year after adjusting for age, sex and education (~6.9 days per month).25 This was six-fold greater than the national average of disability days. Nonetheless, this prior study did not distinguish between those with obstructive versus nonobstructive CAD. Additionally, disability days leveled off within the second year similar to the pre-event year.25

The current results suggest that patients with INOCA often initially live with diagnostic uncertainty despite the presence of symptoms that adversely impact their lives. Most patients reported living with their symptoms for at least 1 year before a diagnosis was made, with almost half experiencing symptoms of INOCA for 1 to 10 years before diagnosis. More than half had seen three or more consultants before their diagnosis of INOCA was made, and three or more cardiologists for the treatment of INOCA. Many reported undergoing endoscopy or psychiatric evaluation of their symptoms. Even for these patients with a diagnosis of INOCA, less than a third had undergone cardiac catheterization with coronary flow reserve testing to determine optimal medical therapies, given that there are many different forms of INOCA. This on top of a lack of understanding of INOCA even within the cardiology community, results in the signs and symptoms of INOCA often being downplayed, dismissed and often untreated and undiagnosed.26

**Study Limitations:**

There are several limitations in this study. Although most respondents were female, limiting implications somewhat to men, however INOCA is a condition that predominantly affects women. This survey was limited to the patient support group of INOCA International. Accordingly, the survey reflects: (1) participants had an established diagnosis or suspicion of INOCA; (2) they had undergone some evaluation for this diagnosis; (3) they had had time to join a patient-focused support group; and (4) they may have sought out such an organization because of issues related to getting a diagnosis or living with active symptoms of INOCA, and thus may not represent all INOCA patients. A survey-based study will always be limited to a higher literacy audience and may unintentionally exclude those INOCA patients with lower levels of literacy. Because the survey was administered online, there was no interviewer to probe the respondents and ensure understanding of the intention of the questions. There is survival bias in this study, and it remains unknown how large the population of INOCA patient is, but it is likely patients remain undiagnosed and untreated and would not be represented in this study. Reports of applications for disability and successful approval differ from one country to another, and although we do not know where these participants live, this is a UK-based organization. In addition, the survey did not distinguish between short-term or long-term disability. Certainly, recall bias can limit the self-interpretation of quality of life and functional capacity prior to INOCA symptoms. Functional capacity was estimated using the DASI questionnaire, but this has been validated in populations living with ischemic heart disease including those with INOCA from the WISE study.7, 8, 11, 27, 28 Information on pharmacological and non-pharmacology therapy was not collected, so we are unable to assess how treatment may influence any of the self-reported measures. Lastly, we have included respondents with a diagnosis of INOCA who also reported being diagnosed with Takotsubo Cardiomyopathy, given that a prevailing hypothesis is that the underlying pathophysiologic process may be due to underlying coronary microvascular ischemia.29

**Conclusions**

INOCA symptoms are associated with adverse physical, mental and social health quality of life, comparable to patients with symptoms of obstructive CAD. Additionally, functional capacity declines are evident following onset of INOCA symptoms. Increased patient awareness, physician recognition and diagnosis, and clinical trials are needed to develop evidence-based guidelines for this increasingly recognized cardiovascular disorder.

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**Table 1. Participant Characteristics**

|  |  |
| --- | --- |
|  | Respondents(N= 297) |
| **Men** | 26 (8.8) |
| **Established Diagnoses**CMDCoronary Artery SpasmNonobstructive atherosclerosisHeart Failure with Preserved Ejection FractionTakotsubo Cardiomyopathy/Stress CardiomyopathyNot given any diagnosis aside from INOCAUnknownMINOCA | 191 (64.3)150 (50.5)18 (6.1)13 (4.4)13 (4.4)24 (8.1)13 (4.4)67 (22.6) |
| **Age at Diagnosis of INOCA**<30 Years30-4040-50 Years50-60 Years>60 Years | 8 (2.7)29 (9.8)77 (25.9)115 (38.7)54 (18.2) |
| **Comorbidities**Migraines/ frequent headachesRaynaud's Thyroid disorderRheumatoid ArthritisLupus/ systemic lupus erythematosusOther autoimmune disorderHistory of strokeKidney diseaseNone | 138 (46.5)64 (21.5)64 (21.5)16 (5.5)4 (1.3)64 (21.5)10 (3.3)15 (5.1)76 (25.6) |
| **Adverse Pregnancy Outcomes**Hypertension During pregnancyPreeclampsia or EclampsiaGestational DiabetesPreterm DeliveryMiscarriageDoes Not Apply To Me/I have Never Been Pregnant | 140 (47.1)55 (18.5)38 (12.8)24 (8.1)36 (12.1)75 (25.2)139 (46.8) |

Legend: INOCA -Ischemia with No Obstructive Coronary Arteries. MINOCA- Myocardial Infarction with No Obstructive Coronary Arteries

**Table 2. INOCA Symptoms, Trigger, Referral Patterns & Evaluation**

|  |  |
| --- | --- |
|  | Respondents(N= 297) |
| **Years With INOCA Symptoms**<1 Year1-5 Years5-10 Years10-20 Years>20 Years | 34 (11.4)120 (40.4)62 (20.9)46 (15.5)21 (7.1) |
| **Time From Symptom Onset to Diagnosis of INOCA**<1 Month1 Month-1Year1-3 Years3-10 Years>10 Years | 26 (8.8)92 (31.0)67 (22.6)73 (24.6)29 (9.8) |
| **Clinical Assessment of Symptoms**Told that Symptoms were Not CardiacSeen in ED for Symptoms+ Discharged without TreatmentTold that although symptoms of INCOA are unpleasant, you cannot die from it or have a heart attackHad ever called an ambulance for symptomsKnew when to call an ambulance or go to the hospital for INOCA symptoms | 224 (77.8)200 (69.4)188 (66.4)166 (58.7)184 (65.5) |
| **Ambulance Response to INOCA Symptoms**Taken to hospital+ ECG+ MonitorNo ambulance dispatchedAssessed by ambulance crew but not taken to hospitalTaken to hospital but no ECG or cardiac monitor performedAmbulance crew understood the diagnosis of INOCAAmbulance crew did not understand the diagnosis of INOCAI never had to call an ambulanceI do not call the ambulance because they do not take my symptoms seriously | 147 (49.4)9 (3.2)39 (13.8)23 (8.2)25 (8.4)75 (27.0)97 (34.4)43 (15.3) |
| **Symptoms**General: Fatigue/exhaustion, SweatsCardiovascular:  Chest pain/chest pressure/chest discomfort Palpitations Shortness of breath Back, shoulder, arm, neck, jaw painNeurologic: Confusion, brain fog, vision changes, light headedness, dizzinessGastrointestinal: Nausea, reflux-like symptomsOther | 260 (87.5)276 (92.9)181 (60.9)239 (80.5)242 (81.5)230 (77.4)146 (49.2)45 (15.2) |
| **Triggers**StressExercise/ExertionExcitement or High Emotional State/AngerCold WeatherChange in Temperature or Weather ChangeTriggered during MenstruationOtherNo Known Triggers | 237 (79.8)218 (73.4)205 (69.0)178 (59.9)145 (48.8)49 (16.5)70 (23.6)18 (6.1) |
| **Did Symptoms Change at Menopause?**YesNo UnsureHave Not Undergone MenopauseMale- Does Not ApplyNo Response | 75 (25.3)45 (15.2)80 (26.9)53 (17.8)26 (8.8)18 (6.1) |
| **Prior to the Diagnosis of INOCA:**Told Symptoms Were Due to GERDUnderwent Endoscopy to Assess for GERDTold Symptoms Were Not CardiacReferred to a Psychiatrist for SymptomsRecommended to Start Antidepressant/Antianxiety Medication for SymptomsSeen in the ED For Symptoms of INOCA & Discharged Without Treatment | 160 (53.9)96 (32.3)223 (75.1)94 (31.6)125 (42.1)200 (67.3) |
| **Total Consults Seen Prior to INOCA Diagnosis**Diagnosed Right Away1-2 Additional Consults3-5 Additional Consults>5 Additional Consults | 19 (6.4)86 (28.9)105 (35.4)75 (25.3) |
| **Non-invasive Imaging** ECGEchocardiogram Exercise Stress TestStress EchocardiogramCT AngiogramCardiac MRIPET Scan**Invasive Imaging** Cardiac CatheterizationCardiac Catheterization with Acetylcholine Testing | 277 (93.3)261 (87.9)242 (81.5)201 (67.7)145 (48.8)134 (45.1)138 (46.5)31 (10.4)216 (72.7)185 (62.3)97 (32.7) |
| **Number of Cardiologists Consulted for Treatment of INOCA**12≥3 | 60 (20.2)76 (25.6)149 (50.2) |
| **Finding An INOCA Specialist**Self-ReferredReferred by CardiologistReferred by Family Doctor or Other DoctorNever Under the Care of an INOCA Specialist | 106 (35.7)45 (15.2)18 (6.1)114 (38.4) |
| **Currently Under the Care of an INOCA Specialist** | 146 (49.2) |

Legend: CT computed tomography; ECG electrocardiogram; GERD Gastroesophageal Reflux Disease; INOCA Ischemia with No Obstructive Coronary Arteries, MRI magnetic resonance imaging; PET positron emission tomography

**Table 3. Health Status and Quality of Life**

|  |  |
| --- | --- |
|  | Total Respondents(N= 297) |
| **Overall Health After Onset of Symptoms**ExcellentVery GoodGoodFairPoorDid not answer | 6 (2.0)48 (16.3)87 (29.5)97 (32.7)57 (19.2)2 (0.7) |
| **Functional Capacity Level by DASI (METs) Prior to Onset of INOCA Symptoms**<5 METs5-8METs>8 METsEstimated Exercise Capacity (METs)  | 15 (5.1)63 (21.2)207 (69.7)8.6±1.8 |
| **Functional Capacity Level by DASI (METs) After Onset of Symptoms**<5 METs5-8METs>8 METsEstimated Exercise Capacity (METs)  | 123 (41.4)128 (43.1)34 (11.4)5.6±1.8 |
| **Mental Health After Onset of Symptoms**INOCA Adversely affected your Mental HealthINOCA Negatively affected your Outlook on Life | 209 (70.4)207 (69.7) |
| **Social Health After Onset of Symptoms**INOCA Adversely affected Home LifeINOCA Adversely affected your Relationship with Partner/SpouseINOCA Adversely affected your Social LifeINOCA Adversely affected your Sex Life | 239 (80.5)160 (53.9)238 (80.1)166 (55.9) |
| **Work & Disability After Onset of Symptoms**INOCA Adversely affecting Work LifeReduced Work Hours due to INOCA symptomsRetired Early because of INOCAChanged Job/Roles for less stressful Position due to INOCA symptomsChanged Job/Roles resulting in Lower Pay due to INOCA symptomsApplied for Disability because of INOCA symptomsSuccessful Application for Disability Benefits | 205 (69.0)167 (56.2)141 (47.5)111 (37.4)97 (32.7)114 (38.4)88 (77.2) |

Legend: DASI Duke Activity Status Index; INOCA Ischemia with No Obstructive Coronary Arteries; METs metabolic equivalents

**Table 4. Estimated Functional Capacity Prior and Following Symptom Onset Stratified by Diagnosis**

|  |  |  |  |
| --- | --- | --- | --- |
| **INOCA Forms** | **Functional Capacity Prior to Symptoms Onset (METS±SD)** | **Functional Capacity Post Symptom Onset (METS±SD)** | **P-Value**  |
| ALL INOCA (N=297)CMD (N=191)Coronary artery spasm (N=150)Nonobstructive atherosclerosis (N=18)HFpEF (N=13)Takutsubo Cardiomyopathy (N=13)I don't know/I wasn't diagnosed (N=37) | 8.6 ±1.88.5 ±1.98.7 ±1.98.3 ±2.28.3 ±2.18.3 ±1.78.6 ±1.6 | 5.6 ±1.85.3 ±1.75.6 ±1.85.4 ±1.94.5 ±0.94.7 ±0.86.1 ±2.0 | <0.0001<0.0001<0.0001<0.0001<0.0001<0.0001<0.0001 |

Legend: CMD coronary microvascular dysfunction; HFpEF heart failure with preserved ejection fraction; INOCA Ischemia with No Obstructive Coronary Arteries; METs metabolic equivalents; SD standard deviation

Figures Titles and Legends

Figure 1. **Estimated Functional Capacity Based on Impact of INOCA on Specific Aspects of Life**

Functional capacitybased on impact of INOCA on specific aspects of life

*Legend: INOCA= Ischemia with No Obstructive Coronary Arteries; METs= metabolic equivalents*

Figure 2. **Estimated Functional Capacity Based on Impact of Living with INOCA on Work and Disability**

Functional capacityin those living withINOCA based on specific aspects of work and application for disability

*Legend: INOCA= Ischemia with No Obstructive Coronary Arteries; METs= metabolic equivalents*

Figure 3. **Living with INOCA and** **Days of Declining Health Per Month For Every 1 MET Decrease in Functional Capacity**

Number of days per month of declining physical and mental health, and ability to perform recreational activities, for every unit (MET) of decline in functional capacityfor those living with INOCA (± Standard Deviation)

*Legend: INOCA= Ischemia with No Obstructive Coronary Arteries; METs= metabolic equivalents*

Central Figure. **Impact of Living with INOCA on Physical, Mental, Social Health & Work-Life**

*Legend: INOCA= Ischemia with No Obstructive Coronary Arteries; METs= metabolic equivalents*

Figure 1.

Figure 2.



Figure 3.



Central Figure

Appendix 1. Survey

|  |  |  |  |
| --- | --- | --- | --- |
| INOCA SurveyWe are interested in how living with INOCA (Ischemia with No Obstructive Coronary Arteries) has impacted your medical care, health and life. Your responses will remain anonymous. Thank you for your time in responding to our questions.Question 1Do you have Ischemia with No Obstructive Coronary Arteries (INOCA)?[ ]  Yes[ ]  No (if No, no further questions)Question 2Would you say that your general health is:[ ]  Excellent[ ]  Very Good[ ]  Good[ ]  Fair[ ]  PoorQuestion 3Which of the following forms of INOCA were you diagnosed with? (Check all that apply)[ ]  Coronary Microvascular Dysfunction[ ]  Coronary Artery Spasm[ ]  Nonobstructive Atherosclerosis[ ]  Heart Failure with Preserved Ejection Fraction (HFpEF)[ ]  Takutsubo’s Syndrome (also known as Stress Cardiomyopathy/”Broken Heart” Syndrome)[ ]  I was not given a diagnosis aside from INOCA[ ]  I don’t knowQuestion 4How long did it take from the onset of your symptoms to getting a diagnosis of INOCA?[ ]  Less than 1 months [ ]  1-12 months [ ]  1-3 years[ ]  3-5 years[ ]  5-10 years[ ]  >10 yearsQuestion 5Prior to your diagnosis of INOCA were you ever told your symptoms were due to Reflux or GERD (gastroesophageal reflux disease)?[ ]  Yes [ ]  NoQuestion 6Prior to your diagnosis of INOCA did you undergo an endoscopy to assess for reflux/GERD based on your symptoms? [ ]  Yes [ ]  No Question 7Prior to your diagnosis of INOCA were you ever told your symptoms were not cardiac?[ ]  Yes[ ]  NoQuestion 8Prior to your diagnosis of INOCA were you seen in the Emergency Room/A&E for your symptoms of INOCA and discharged without any treatment?[ ]  Yes[ ]  NoQuestion 9Prior to your onset of symptoms of INOCA, which of the following could you **previously** do? (Check All That Apply)[ ]  Take Care of Yourself (ie. dress, eat, bathe, use toilet)[ ]  Walking Indoors[ ]  Walk 200 yards (182 meters) on level ground[ ]  Climb a flight of stairs or walk up a hill[ ]  Run a Short Distance[ ]  Do light work around the house (ie. dusting, washing dishes)[ ]  Do moderate work around the house (ie. vacuuming, sweeping floors, carrying groceries)[ ]  Do heavy work around the house (ie. scrubbing floors, lifting or moving heavy furniture)[ ]  Do yardwork (ie. raking leaves, weeding, pushing a lawn mower)[ ]  Have Sexual Relations[ ]  Participate in Moderate Recreational Activities (ie. golf, bowling, doubles tennis, throwing baseball, kicking football)[ ]  Participate in Strenuous Sports (ie. swimming, singles tennis, football, basketball, skiing)Question 10With your diagnosis of INOCA, which of the following can you **currently** do? (Check All That Apply)[ ]  Take Care of Yourself (ie. dress, eat, bathe, use toilet)[ ]  Walking Indoors[ ]  Climb a flight of stairs or walk up a hill[ ]  Run a Short Distance[ ]  Do light work around the house (ie. dusting, washing dishes)[ ]  Do moderate work around the house (ie. vacuuming, sweeping floors, carrying groceries)[ ]  Do heavy work around the house (ie. scrubbing floors, lifting or moving heavy furniture)[ ]  Do yardwork (ie. raking leaves, weeding, pushing a lawn mower)[ ]  Have Sexual Relations[ ]  Participate in Moderate Recreational Activities (ie. golf, bowling, doubles tennis, throwing baseball, kicking football)[ ]  Participate in Strenous Sports (ie. swimming, singles tennis, football, basketball, skiing)Question 11How many consultants/specialists/doctors did you see prior to your diagnosis of INOCA?[ ]  0 (meaning diagnosed right away)[ ]  1-2[ ]  3-5[ ]  >5Question 12How many cardiologists have you consulted for treatment of your INOCA?[ ]  1 [ ]  2[ ]  3-5[ ]  >5Question 13Prior to your diagnosis of INOCA were you ever referred to a psychiatrist for your symptoms or was such a referral suggested to you by your doctor? [ ]  Yes[ ]  NoQuestion 14Have you ever been started on, or been recommended to start, an antidepressant or antianxiety medication for your INOCA symptoms? [ ]  Yes[ ]  NoQuestion 15Are you under the care of a specialist in INOCA?[ ]  Yes [ ]  No[ ]  Awaiting Initial Appointment[ ]  I Don’t KnowQuestion 16If you under the care of a specialist in INOCA, how did you get to them?[ ]  Self-Referred (I found the specialist myself) [ ]  My Family Doctor/GP referred me to the INOCA specialist[ ]  Another cardiologists referred me to the INOCA Specialist[ ]  Another doctor referred me to the INOCA Specialist[ ]  AI have never been under the care of an INOCA Specialist

|  |  |
| --- | --- |
| Question 17How many years have you had symptoms of INOCA for?[ ]  Less than 1 year [ ]  1-5 years [ ]  5-10 years[ ]  10-20 years[ ]  >20 yearsQuestion 17At What Age were you Diagnosed with INOCA?[ ]  Less than 30 [ ]  30-40 [ ]  40-50[ ]  50-60[ ]  60-70[ ]  >70 yearsQuestion 18Have you ever had a Heart Attack? [ ]  Yes[ ]  No[ ]  UnsureQuestion 19Have you ever been told that although your symptoms of INOCA may be unpleasant, you cannot die from it and cannot have a heart attack? [ ]  Yes[ ]  NoQuestion 20Have you ever had to call an Ambulance for your symptoms of INOCA? [ ]  Yes[ ]  NoQuestion 21When you have called an Ambulance for your symptoms of INOCA, have you experienced any of the following? (choose all that apply) [ ]  Taken to the Hospital and Cardiac Monitor Attached and ECG performed[ ]  No Ambulance dispatched[ ]  Assessed by Ambulance Crew but not taken to the hospital[ ]  Taken to the Hospital but No Cardiac Monitor or ECG performed despite symptoms[ ]  Ambulance Crew Understood the Diagnosis of INOCA[ ]  Ambulance Crew DID NOT Understand the Diagnosis of INOCA[ ]  I have never had to call an Ambulance[ ]  I do not call the Ambulance because they do not take my symptoms seriouslyQuestion 22As a patient living with INOCA, do you know when to call for an ambulance or go to the hospital for your INOCA symptoms?[ ]  Yes[ ]  No |  |

Question 23Which diagnostic tests have you had related to your INOCA symptoms? (Check all that apply)[ ]  ECG[ ]  Echocardiogram (also called Echo)[ ]  Exercise Stress Test[ ]  Stress Echocardiogram (Also called Stress Echo)[ ]  CT Angiogram[ ]  Cardiac MRI[ ]  PET Scan[ ]  Cardiac Catheterization (Also called Angiogram)[ ]  Cardiac Catheterization (Also called Angiogram) with Acetylcholine Testing[ ]  None of the AboveQuestion 24Which symptoms do you experience related to INOCA? (Check all that apply)[ ]  Chest Pain/Chest Pressure/Chest Discomfort[ ]  Fatigue/Exhaustion[ ]  Shortness of Breath[ ]  Back Pain[ ]  Shoulder or Arm Pain or Pressure[ ]  Neck/Jaw Pain[ ]  Palpitations/Racing of the heart[ ]  Sweats[ ]  Lightheadedness, Dizzyness[ ]  Nausea, reflux-like symptoms[ ]  Confusion, Brain Fog[ ]  Vision Changes[ ]  OtherQuestion 25Have You Ever Left any Doctor’s Appointment and come away thinking they did not understand INOCA?[ ]  All the Time[ ]  Often[ ]  Occasionally[ ]  NeverQuestion 26Have You Ever Had to Stop Working because of INOCA?[ ]  Yes[ ]  NoQuestion 27Did You Had to Retire Early because of INOCA?[ ]  Yes[ ]  NoQuestion 28Have You Ever Had to Reduce Working Hours because of INOCA?[ ]  Yes[ ]  NoQuestion 29Have You Ever Had to Change Jobs or Roles for a Less Stressful Position because of your symptoms from INOCA?[ ]  Yes[ ]  NoQuestion 30Have You Ever Had to Change Jobs or Roles that Resulted in Lower Pay Because of your Symptoms with INOCA?[ ]  Yes[ ]  NoQuestion 31Have You Ever Had to Apply for Disability Benefits because of your symptoms with INOCA?[ ]  Yes[ ]  NoQuestion 32If You Had to Apply for Disability Benefits because of your symptoms with INOCA, was your application successful?[ ]  Yes[ ]  No[ ]  I have never applied for disability benefitsQuestion 33Do You Ever Worry about being home alone?[ ]  Yes[ ]  NoQuestion 34Do You Ever Worry about going out alone?[ ]  Yes[ ]  NoQuestion 35Do You Drive?[ ]  Yes,[ ]  No, stopped due to INOCA symptoms[ ]  Never DroveQuestion 36Did you have any of the following conditions during pregnancy? (check all that apply)[ ]  Hypertension During pregnancy[ ]  Preeclampsia or Eclampsia[ ]  Gestational Diabetes [ ]  Preterm Delivery[ ]  Miscarriage[ ]  Does Not Apply To Me, I have Never Been PregnantQuestion 37Do you have any of the following conditions? (check all that apply)[ ]  Migraines/ Frequent Headaches[ ]  Raynaud’s [ ]  Thyroid Disorder [ ]  Rheumatoid Arthritis[ ]  Lupus/ Systemic Lupus Erythematosus[ ]  Other Autoimmune Disorder[ ]  History of Stroke[ ]  Kidney Disease[ ]  NoneQuestion 38Do You Have Any of the Following Triggers for Your Symptoms of INOCA?[ ]  Stress[ ]  Exercise/Exertion[ ]  Excitement or High Emotional State/Anger[ ]  Cold Weather[ ]  Change in Temperature or Weather Change[ ]  Triggered during Menstruation[ ]  Other [ ]  No Known TriggersQuestion 39Did Your Symptoms Change at Menopause?[ ]  Yes[ ]  No[ ]  Unsure[ ]  Have not Undergone Menopause Yet[ ]  Male (Not Applicable)Question 40Has INOCA Adversely Affected Your Home Life?[ ]  Yes[ ]  NoQuestion 41Has INOCA Adversely Affected Your Relationship with Your Partner/Spouse?[ ]  Yes[ ]  No[ ]  Not applicableQuestion 42Has INOCA Adversely Affected Your Work Life?[ ]  Yes[ ]  NoQuestion 43Has INOCA Adversely Affected Your Social Life?[ ]  Yes[ ]  NoQuestion 44Has INOCA Adversely Affected Your Sex Life?[ ]  Yes[ ]  No[ ]  Not applicableQuestion 45Has INOCA Adversely Affected Your Mental Health?[ ]  Yes[ ]  NoQuestion 46Has INOCA Negatively Affected Your Outlook on Life?[ ]  Yes[ ]  NoQuestion 47Thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?[ ]  \_\_ (no number >30 will be accepted)Question 48Thinking about your mental health, which includes stress, depression and problems with emotions, for how many days during the past 30 days was your mental health not good?[ ]  \_\_(no number >30 will be accepted)Question 49During the past 30 days, for how many days did poor physical health or mental health, keep you from doing your usual activities, such as self-care, work or recreation?[ ]  \_\_(no number >30 will be accepted)IF YOU WOULD LIKE TO SHARE ANY OTHER COMMENTS WITH YOU ABOUT YOUR EXPERIENCE LIVING WITH INOCA, PLEASE FEEL FREE TO WRITE ANY COMMENTS HERE:    |  |