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# An improved questionnaire for assessing quality of life after acute myocardial infarction

**L. Valenti, L. Lim,* R. F. Heller and J. Knapp**

Centre for Clinical Epidemiology and Biostatistics, Faculty of Medicine and Health Sciences, The University of Newcastle, Newcastle NSW AUSTRALIA

**This paper reports our experience with the use of an improved self-administered questionnaire for assessing quality of life (QOL) after acute myocardial infarction. The modified questionnaire significantly increased the proportion of patients able to answer all questions from 84%–92%. The additional questions in the improved questionnaire increased the total variance explained by the Emotional, Physical and Social QOL factors from 65.8%–66.5%. Internal consistency and construct validity were assessed and found to be high. Overall, we have found that this improved questionnaire is easy to administer and that it possesses desirable properties of validity and reliability.**

*Key words*: Acute myocardial infarction; quality of life; self administered questionnaire.

## Introduction

Cardiovascular disease is currently the major cause of death in Australia and other developed countries,[1,2] and is a growing concern in many developing countries.[3] There has been a noticeable shift in recent years towards a focus on disease-specific quality of life(QOL) as the primary outcome measure in studies of cardiovascular disease.[4,5,6,7] In particular, there appears to be a demand for reliable, sensitive and validated questionnaires which measure QOL following acute myocardial infarction (AMI), which can be used in a patient self-administered mode.[8]

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To whom correspondence should be addressed at Centre for Clinical Epidemiology and Biostatistics, David Maddison Clinical Sciences Building, Royal Newcastle Hospital, Newcastle NSW 2300. Tel: (049) 236152; Fax: (049) 236148.

The Quality of Life after Myocardial Infarction Questionnaire (QLMI) was developed at McMaster University, Canada.[9] Previous use of the QLMI questionnaire in Newcastle, Australia found it can be successfully applied in a patient self-administered mode.[8,10] Following this experience we made a few minor modifications to the original questionnaire.[8,10] In a recent study of the impact of counselling on patients following hospitalization for suspected AMI,[11] the modified QLMI questionnaire (QLMI-2), was again applied in a self-administered mode to assess QOL.

This paper reports the performance of the QLMI-2 questionnaire as a tool for measuring QOL 6 months after hospital discharge. The specific aims were to compare patient responses to the original QLMI questionnaire used in a self-administered mode with responses to the QLMI-2 questionnaire; to determine the consistency of QOL scores obtained from two different groups of comparable AMI patients; to assess if the three new questions added to the original questionnaire performed as expected; and to assess the reliability and validity of the QLMI-2 questionnaire.

## Methods

### Modification of the original QLMI questionnaire

Questions in the original QLMI questionnaire fall into three QOL domains which assess 'emotional', 'physical' and 'social' QOL.[8,10] The questions use a Likert-scale with seven possible responses, where a '1' represents the lowest QOL and '7' the highest. A QOL domain score was obtained by calculating the average Likert responses across all questions allocated to that domain.

The original QLMI questionnaire used by the McMaster group comprised 26 questions and was

interviewer-administered.[9,12] When the questionnaire was used in a self-administered mode on an Australian population, three of the 26 questions were omitted from the analysis: one was considered inappropriate in the Australian setting, the interpretation of another was ambiguous and a third question, which addressed sexual intercourse, was unanswered by many respondents.[8,10] The QLMI-2 questionnaire is a modification of our first self-administered version of the QLMI questionnaire. In QLMI-2 the sex question was amended to include a not-applicable response and three new questions were added, giving a total of 27 items. The three new questions (questions 24, 25 and 26) focus on the social and physical domains, as our previous work found that relatively few questions fell into these domains.[8] The QLMI-2 questionnaire is included in an unabridged format in the Appendix.

### The 1990–91 study

A study of 450 AMI patients aged between 25 and 69 years was carried out between September 1990 and December 1991 to assess the effect on QOL of an information mail-out intervention.[10] QOL was measured 6-months after hospital discharge using the original QLMI questionnaire in a self-administered mode, to which 375 (83%) patients responded. Patients were recruited from hospitals in the Lower Hunter region of New South Wales, Australia.

### The 1993–94 study

The QLMI-2 questionnaire was administered to patients with AMI or angina recruited between May 1993 and March 1994, for a study which assessed the impact of counselling on QOL measured at 6 weeks and 6 months after discharge from hospital.[11] Patients were recruited from the same hospitals as in the 1990–91 study. Seventy-one per cent of the subjects, who ranged in age from 25–74 years, were male and 75% had not previously had an AMI. A total of 490 subjects were enrolled, of whom 352 (72%) responded to the 6-month questionnaire.

### Quality of life measures

Only 6-month QOL scores were examined in this paper as QOL has been reported to reach a 'steady-state' between 2–12 months after the AMI event.[9] Heller *et al.*[11] found that emotional quality of life scores declined at 6 weeks post discharge, but by 6 months had returned to levels similar to scores measured while in hospital.

### Statistical methods

Principle components factor analysis with a varimax rotation was used to determine the allocation of items in the QLMI-2 questionnaire to the underlying QOL domains.[13] Reliability was assessed by measuring internal consistency (scale reliability) separately for each of the three domains using Cronbach's $\alpha$.[14]

Construct validity was assessed by determining the association between QOL scores separately for each of the three domains, and study variables previously reported to be associated with QOL: previous AMI, sex, rehospitalization within 6 months after discharge, whether coronary artery bypass surgery was performed within the 6 month follow-up period, clinical diagnosis (AMI or angina) and age group ($<60$ or $\geq 60$).[15,16,17] The statistical significance of these associations was computed using the Wilcoxon 2-sample test.[18]

The Wilcoxon 2-sample test was also used to compare the QOL domain scores between the 1990–91 and 1993–94 patient samples. For these comparisons, patients aged 70 years and over in the 1993–94 study were excluded and computation of QOL scores excluded the three new questions.

## Results

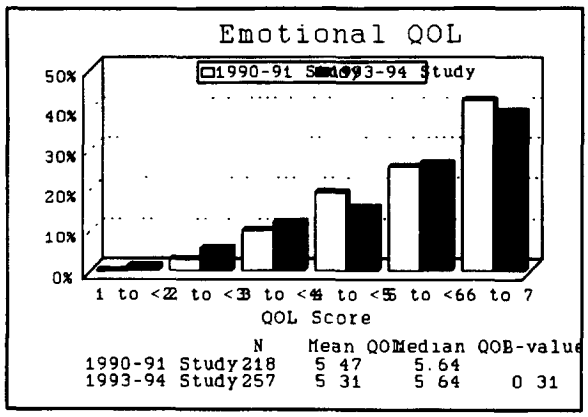
### Use of the original QLMI vs. the QLMI-2 Questionnaire

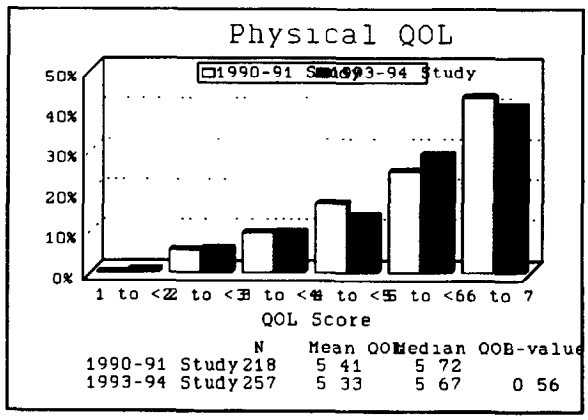
Three hundred and sixteen of the 375 (84%) respondents in the 1990–91 study answered all the questions in the original QLMI questionnaire compared with 322 of the 352 (91.5%) respondents in the 1993–94 study. Only 4.3% of respondents to the 1993–94 study did not answer the sex question (question 27), compared to 12.3% in the 1990–91 study. Further, 49.6% of the 1990–91 respondents gave the response 'none of the time' in relation to how often their heart problem interfered with sexual intercourse, while in the 1993–94 study 31.8% gave the 'none of the time' response and 27% gave the 'not applicable' response. This question was excluded from the following analysis.

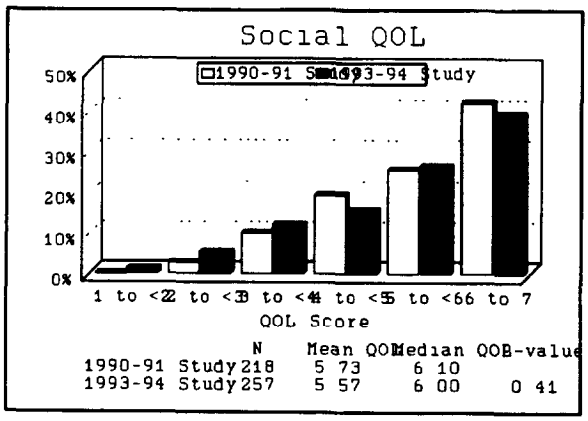
## Consistency of QOL scores between two comparable patient samples

Demographic characteristics of the 1990–91 and 1993–94 patient samples were comparable in all respects, except that the 1993–94 study had a higher proportion of smokers (33% vs. 21%) and of patients diagnosed as having definite AMI (50% vs. 38%). Virtually identical distributions of emotional, physical and social QOL scores were seen in the two patient samples (Figure 1). The 1990–91 patient sample had a marginally higher, but not statistically significant, proportion of patients with QOL scores ≥6 (Emotional: 42.2% vs. 39.3%; Physical: 43.1% vs. 40.9%; Social: 54.1% vs. 50.2%).

**Figure 1.** Distribution of QOL scores for the two comparable AMI patient samples. *p*-value from Wilcoxon Two-Sample Test




## Performance of the three new questions

The factor weights obtained from factor analysis on the QLMI-2 questionnaire responses at 6 months are shown in Table 1. The weight has been shown as bold and underlined if it would be allocated to a domain based on the decision rule of allocating an item to a domain if the weight is ≥0.4.[8] For example, question 1 was allocated only to the emotional domain, while question 6 was allocated to both the emotional and physical domains (Table 1).

Overall the percentage of variance explained increased from 65.8%–66.5% with the addition of the three new questions. The variance explained by the social domain increased markedly from 18.4%–21.4% while the variances attributable to the physical and emotional domains deteriorated slightly, from 18.1%–17.1% and from 29.3%–28% respectively. Questions 24 and 25 appeared to impact most strongly on the social domain, but also contribute to the physical domain. Question 26 impacted equally on the physical and social domains.

## Internal consistency

Cronbach's α coefficient was very high for all three domains (0.95, 0.93 and 0.95 for the emotional, physical and social domains respectively), indicating a very high degree of homogeneity of items within a domain. When items within a domain were excluded one at a time, the α values did not fall below α for the domain in total, giving further indication that questions in each domain are measuring the same construct.[19]

## Construct validity

Subjects who had not suffered a previous AMI and those not readmitted to hospital in the 6 month follow-up period were found to have a statistically significantly higher QOL in all three domains. (Previous AMI—Emotional: 5.08 ± 1.37 vs. 5.4 ± 1.22;

**Table 1.** Factor weights and variance explained from factor analysis

| | Emotional | Physical | Social |
|---|---|---|---|
| 1. Frustrated | **0.79** | 0.25 | 0.15 |
| 2. Worthless | **0.74** | 0.16 | 0.42 |
| 3. Confident | **0.61** | 0.26 | 0.37 |
| 4. Down in the dumps | **0.86** | 0.22 | 0.23 |
| 5. Relaxed | **0.79** | 0.26 | 0.21 |
| 6. Worn out | **0.59** | 0.52 | 0.17 |
| 7. Happy with personal life | **0.73** | 0.21 | 0.28 |
| 8. Restless | **0.81** | 0.29 | 0.21 |
| 9. Short of breath | 0.24 | **0.73** | 0.32 |
| 10. Tearful | **0.72** | 0.17 | 0.20 |
| 11. More dependent | 0.39 | 0.20 | **0.62** |
| 12. Social activities | **0.40** | 0.46 | 0.52 |
| 13. Others/less confidence in you | **0.45** | 0.08 | 0.66 |
| 14. Chest pain | 0.17 | **0.72** | 0.17 |
| 15. Lack self-confidence | **0.67** | 0.19 | 0.47 |
| 16. Aching legs | 0.39 | **0.44** | 0.05 |
| 17. Sports/exercise limited | 0.23 | **0.60** | 0.61 |
| 18. Frightened | 0.63 | 0.25 | 0.36 |
| 19. Dizzy/lightheaded | 0.39 | **0.61** | 0.07 |
| 20. Restricted or limited | 0.21 | **0.64** | 0.62 |
| 21. Unsure about exercise | 0.34 | **0.47** | 0.48 |
| 22. Overprotective family | 0.18 | 0.00 | **0.69** |
| 23. Burden on others | **0.44** | 0.20 | 0.66 |
| 24. Excluded | 0.19 | **0.43** | 0.74 |
| 25. Unable to socialize | 0.23 | **0.46** | 0.68 |
| 26. Physically restricted | 0.17 | **0.60** | **0.65** |
| % Total variance explained | 28.1% | 17.2% | 21.4% Sum=66.5% |
| % Total variance explained (excluding the three extra questions, i.e. items 24, 25 and 26) | 29.3% | 18.1% | 18.4% Sum=65.8% |

(Weight is shown in bold and underlined if item is allocated to that domain according to the decision rule to allocate a question to a domain if the factor weight is greater than or equal to 0.4)

Physical: 5.00 ± 1.47 vs. 5.60 ± 1.18; Social; 5.21 ± 1.51 vs. 5.77 ± 1.25. Readmitted—Emotional: 4.34 ± 1.26 vs. 5.54 ± 1.18; Physical: 4.28 ± 1.44 vs. 5.68 ± 1.13; Social: 4.36 ± 1.48 vs. 5.89 ± 1.16.) Males, those who had by-pass surgery in the 6 month follow-up period, those diagnosed with a definite AMI and those aged 60 or more also showed consistently higher QOL in all three domains, although the associations were not statistically significant.

## Discussion

This study found that the modifications made to the QLMI questionnaire improved the questionnaire in the sense of significantly increasing the proportion of patients able to answer all questions. The total variance explained by the three QOL domains was also increased, primarily in the social domain. Hillers *et al.*[9] argued that the original QLMI questionnaire possessed good face and content validity as a consequence of an exhaustive item selection and reduction process in its development. As our modifications to the questionnaire were relatively minor, it can be argued that the QLMI-2 questionnaire possesses similar properties of face and content validity. It is reassuring that the questionnaire produced similar QOL scores from two independent but comparable patient samples assessed at different points in time.

Our experience with the QLMI-2 questionnaire was that patients responded very favourably. The time taken to complete the questionnaire was typically between 5–10 minutes. By offering a 'not applicable' response to the sexual intercourse question many more patients were able to respond to this question

than in the 1990–91 study (96% vs. 88%). The significantly smaller proportion of 1993–94 patients giving the 'none of the time' response (32% vs. 50%) suggested that some of the 1990–91 patients who would have given the 'not applicable' response, had that option been available, had given the 'none of the time' responses instead. We also suspect that the vast improvement in patient response in terms of numbers of questions answered was due in part to the placement of the sex question at the end of the QLMI-2 questionnaire.

Although this study excluded the question on sexual intercourse from analysis, a possible strategy for inclusion of this question would be to allocate it to the physical domain, and to obtain a physical QOL score by averaging over all the questions allocated to the physical domain answered.

There was some suggestion that telephone administration of the QLMI-2 questionnaire was feasible when patients have a copy of the questionnaire at hand. The initial 41 patients recruited into the 1993–94 study were administered the QLMI-2 questionnaire over the telephone. They were given the questionnaire in hospital, and the research nurse telephoned one week after discharge from hospital to obtain their baseline responses. Although this approach worked very well, it was abandoned because of potential interference with the intervention.

In summary, the QLMI-2 questionnaire was found to be easy to use in a self-administered mode and to display desirable properties of validity and reliability.

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## Appendix

We wish to thank Dr Gordon Guyatt and colleagues at McMaster University, Canada, for their kind permission to publish this modified questionnaire in an unabridged format.

## Quality of Life Questionnaire—QLMI-2

Please leave blank

We would now like to ask you some questions about how you have been feeling **during the last two weeks.**

(Please tick the box that matches your answer)

1. In general, how much of the time during the last two weeks have you felt **frustrated, impatient or angry?**

   All of the time . . . . . ☐ 1
   Most of the time . . . . . ☐ 2
   A good bit of the time . . . . . ☐ 3
   Some of the time . . . . . ☐ 4
   A little of the time . . . . . ☐ 5
   Hardly any of the time . . . . . ☐ 6
   None of the time . . . . . ☐ 7

2. How often during the past two weeks have you felt **worthless or inadequate?**

   All of the time . . . . . ☐ 1
   Most of the time . . . . . ☐ 2
   A good bit of the time . . . . . ☐ 3
   Some of the time . . . . . ☐ 4
   A little of the time . . . . . ☐ 5
   Hardly any of the time . . . . . ☐ 6
   None of the time . . . . . ☐ 7

3. In the past two weeks, how much of the time did you feel **very confident and sure that you could deal with your heart problem?**

   None of the time . . . . . ☐ 1
   A little of the time . . . . . ☐ 2
   Some of the time . . . . . ☐ 3
   A good bit of the time . . . . . ☐ 4
   Most of the time . . . . . ☐ 5
   Almost all of the time . . . . . ☐ 6
   All of the time . . . . . ☐ 7

4. In general, how much of the time did you feel **discouraged or down in the dumps** during the last two weeks?

   All of the time . . . . . ☐ 1
   Most of the time . . . . . ☐ 2
   A good bit of the time . . . . . ☐ 3
   Some of the time . . . . . ☐ 4
   A little of the time . . . . . ☐ 5
   Hardly any of the time . . . . . ☐ 6
   None of the time . . . . . ☐ 7

Please leave blank

5. How much of the time during the past two weeks, did you **feel relaxed and free of tension?**

None of the time . . . . . ☐ 1
A little of the time . . . . . ☐ 2
Some of the time . . . . . ☐ 3
A good bit of the time . . . . . ☐ 4
Most of the time . . . . . ☐ 5
Almost all of the time . . . . . ☐ 6
All of the time . . . . . ☐ 7

6. How often during the last two weeks have you felt **worn out or low in energy?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

7. How **happy, satisfied, or pleased** have you been with your personal life during the past two weeks?

Very dissatisfied, unhappy most of the time . . . . . ☐ 1
Generally dissatisfied, unhappy . . . . . ☐ 2
Somewhat dissatisfied, unhappy . . . . . ☐ 3
Generally satisfied, pleased . . . . . ☐ 4
Happy most of the time . . . . . ☐ 5
Very happy most of the time . . . . . ☐ 6
Extremely happy, could not have been more satisfied or pleased . ☐ 7

8. In general, how often during the last two weeks have you felt **restless, or as if you were having difficulty trying to calm down?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

9. How much **shortness of breath** have you experienced during the last two weeks while doing your day to day physical activities.

Extreme shortness of breath . . . . . ☐ 1
Very short of breath . . . . . ☐ 2
Quite a bit short of breath . . . . . ☐ 3
Moderate shortness of breath . . . . . ☐ 4
Some shortness of breath . . . . . ☐ 5
A little shortness of breath . . . . . ☐ 6
No shortness of breath . . . . . ☐ 7

Please leave blank

10. How often during the last two weeks have you felt **tearful, or like crying?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

11. How often during the last two weeks have you felt as though you were **more dependent** than you were before your heart problem?

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

12. How often during the last two weeks have you felt **unable to do your usual social activities, or social activities with your family?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

13. How often during the last two weeks have you felt as if **others no longer have the same confidence in you as they did before you had the heart problem?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

14. How often during the past two weeks have you **experienced chest pain while doing your day to day activities?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

Please leave blank

15. How often during the last two weeks, have you felt **unsure of yourself or lacking in self-confidence?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

16. How often during the last two weeks have you been **bothered by aching or tired legs?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

17. During the last two weeks how much have you been **limited in doing sports or exercise** as a result of your heart problem?

Extremely limited . . . . . ☐ 1
Very limited . . . . . ☐ 2
Limited quite a bit . . . . . ☐ 3
Moderately limited . . . . . ☐ 4
Somewhat limited . . . . . ☐ 5
Limited a little . . . . . ☐ 6
Not limited at all . . . . . ☐ 7

18. How often during the last two weeks have you felt **apprehensive or frightened?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

19. How often during the last two weeks have you felt **dizzy or lightheaded?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

Please leave blank

20. In general, during the last two weeks, how much have you been **restricted or limited** as a result of your heart problem?

Extremely limited . . . . . ☐ 1
Very limited . . . . . ☐ 2
Limited quite a bit . . . . . ☐ 3
Moderately limited . . . . . ☐ 4
Somewhat limited . . . . . ☐ 5
Limited a little . . . . . ☐ 6
Not at all limited . . . . . ☐ 7

21. How often, during the last two weeks, have you felt **unsure as to how much exercise or physical activity** you should be doing?

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

22. How often during the last two weeks have you felt as if your **family is being overprotective toward you?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

23. How often, during the past two weeks, have you felt as if you were **a burden on others?**

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

24. How often during the last two weeks have you felt **excluded** from doing things with other people because of your heart problem?

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

Please leave blank

25. How often during the last two weeks have you felt **unable to socialize** because of your heart problem?

All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7

26. In general, during the last two weeks, how much have you been **physically restricted or limited** as a result of your heart problem?

Extremely limited . . . . . ☐ 1
Very limited . . . . . ☐ 2
Limited quite a bit . . . . . ☐ 3
Moderately limited . . . . . ☐ 4
Somewhat limited . . . . . ☐ 5
Limited a little . . . . . ☐ 6
Not at all limited . . . . . ☐ 7

27. How often during the last two weeks, have you felt your heart problem **limited or interfered with sexual intercourse?**

Not applicable . . . . . ☐ 0
All of the time . . . . . ☐ 1
Most of the time . . . . . ☐ 2
A good bit of the time . . . . . ☐ 3
Some of the time . . . . . ☐ 4
A little of the time . . . . . ☐ 5
Hardly any of the time . . . . . ☐ 6
None of the time . . . . . ☐ 7