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Integrated care and health-related quality of life in primary care: An exploratory analysis

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Abstract

Objectives

The aim of this study was to evaluate the association between integrated care and health-related quality of life (HRQOL) in a primary care practice population.

Design

A cross-sectional survey study.

Setting

Primary care practice population.

Participants

A sample (n= 5.562) of patients in two GP practices in the Netherlands.

Primary outcome measures

The Rainbow Model of Integrated Care Measurement Tool (RMIC-MT) patient version and EQ-5D were used to assess integrated service delivery and HRQOL. The association between integrated care and HRQOL groups was analysed using multivariate logistic regression.

Results

Overall, 933 respondents with a mean age of 62.1 participated (20 % response rate) in this study. The multivariate analysis revealed that positive organisational coordination experiences were linked to better HRQOL, and less anxiety and depression problems. Unemployment was associated with a poor HRQOL. Aging was associated with more mobility, self-care, usual activity and pain problems. Being married improved the overall HRQOL, and decreased anxiety and depression problems. Finally, female gender was associated with a poor overall HRQOL and more pain and discomfort problems.

Conclusion

The study showed that organizational coordination activities relates to HRQOL of adult patients in a primary care context. Also, unemployment, aging and female gender are accumulating risk factors that should be taken into account when designing integrated primary care programs. The findings highlight the need for enhancing the inter-organizational capacity of primary care practices when planning interventions to improve the HRQOL of people in local communities.

Key words

Integrated care, care coordination, triple aim, primary care, Health-related quality of life, the Netherlands; survey

Strengths and limitations of this study

- This is the first study to assess the relationship between integrated care and health-related quality of life (HRQOL) in a primary care practice population based on the theory of the Rainbow Model of Integrated Care (RMIC).

- The analysis identified that organisational integration was positively associated with HROQL.

- Due to the cross-sectional study design the causal relationship between integrated care and HRQOL and influencing factors require further exploration.

Introduction

Primary care is considered the corner stone for integrating health and social services for people in local communities [1]. It is also the first level of care where health is promoted and disease prevented. In countries with a strong primary care system, such as the Netherlands, general practitioners (GPs) provide person-centred continuous care to people in local communities.

General practitioners often collaborate with practice nurses, community pharmacists, medical specialists and home care teams to deliver integrated care (i.e. in care groups, community health centres, bundled payments, subsidies programs). Yet, the coordination of care between these providers is considered to be insufficient in the Netherlands, leading to fragmented care delivery [2]. There is a growing concern about the lack of a coherent long-term policy to enhance the organization of integrated primary care services that ensure all citizens quality of and access to care [3-5].

Throughout this paper we define integrated care as a coordinated way of working across multiple professionals, organisations, and sectors in order to improve the health, quality of care, and economic outcomes for a targeted (sub)population. As described by the Rainbow Model of Integrated Care (RMIC), integrated primary care can be defined as multifaceted health interventions aimed at coordinating care at the clinical (e.g. self-management, case management), professional (e.g. multidisciplinary care, continuity of care), organizational (e.g. disease management, managed care programs) or system (e.g. healthcare policies and regulations) levels [6] (see Figure 1). It is considered that integrated primary care services can improve clinical outcomes, patients' experience of care, and efficiency and costs; the 'Triple Aim' [7]. The underlying assumption is that a significant impact on clinical, quality of care, and economic outcomes requires various interacting interventions targeted at the clinical, professional, organisational, and system levels [8]. However, firm conclusions regarding the effects of integrated primary care on Triple Aim outcomes cannot be made, due to the lack of rigorous long-term evaluation programs [8, 9]. In addition, empirical evidence whether the impact on these outcomes might differ between these integrated care levels is lacking [9, 10]. Most existing studies focus on integrated primary care interventions at the clinical level, while interventions targeted at meso organisational integration and macro system levels are scarce. As a result, few integrated primary care models are widely implemented (e.g. Patient-Centred

Medical Homes, Accountable Care Organisations, Community Care Groups), and to date, the net benefit of integrated primary care and the understanding of how outcomes are achieved remains partly unknown [5, 11-13].

There is a need to determine if integrated care approaches produce better health status outcomes within primary care context. In this context, HRQOL can be considered as an indicator by which patients express their views and perceptions about their health status, which measures the effect that integrated primary care has on them. Several reviews have shown positive effects of integrated care on HRQOL of people with chronic diseases like diabetes [14, 15], heart failure [16], depression [17] and chronic obstructive pulmonary disease [18, 19]. Although this knowledge is valuable, a disease-focused approach is considered dysfunctional in primary care, given that general practitioners' practice population consists of a wide range of patients with vastly different socio-demographics and health problems [6, 20]. Specifically, the essence of primary care is providing person-focused rather than disease-focused care [6, 20]. Yet, published studies describing the content and impact of integrated care models on HRQOL in a general primary care patient population are lacking. Patient-level HRQOL is essential for monitoring integrated primary care and designing improvement programs. Multiple factors like aging [21, 22], unemployment [23, 24], marital status [25], gender [22, 26] and comorbidities [21, 22, 25]have been found to affect HRQOL within a primary care context. Therefore, a comprehensive approach should not only take into account the impact of integrated care on HRQOL, but also the impact of sociodemographic factors like age, gender, marital and employment status.

In view of the above, this study aimed to assess the relation between integrated care and HRQOL of patients in primary care practices in a community setting. We hypothesize that a better overall integrated care experience is positively associated with a better HRQOL. Furthermore, while evidence shows that sociodemographic factors are predictors of HRQOL

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[23-26], little is known about how these factors interfere with integrated care experiences of patients in a community setting. We therefore also aim to explore how gender, age, employment and marital status influence the association between integrated care and HRQOL. We expect this study to provide valuable insight that can be used for tailoring programs to patient's needs and in turn deliver high quality integrated primary care.

[Insert Figure 1]

Methods

The present study used a cross-sectional survey design exploring the relation between integrated care and HRQOL of 4.624 individuals registered in two primary care centres in an urban region in the Netherlands, between June and July 2019.

Participants

Participants in this study were registered in two primary care centres in Brummen (n=1.854) and Eerbeek (n=2.770), The Netherlands. Participants were eligible to participate when they were 18 years or older. Participants that were unable or unwilling to provide informed consent were excluded from the study. The sample size method for an unknown population was used to calculate the sample size. The sample size was estimated to be 963 respondents (481 from each primary care center) according to a standardized medium effect size of 0.3, α error probability of 0.05, power (1−β error probability) of 0.95 and 30 % response rate [27] using the Gpower version 3.1.9.2 [28].

Procedure

Participating primary care centers received a written information package consisting of an introduction letter and patient information sheet to inform the care providers and patients about the study's purpose and data collection methods. Participants were asked written digital informed consent before enrolment in the study procedure. A hyperlink to a web-based survey platform was sent by email. Two reminders were sent to the participants by email. A forced

answering procedure (i.e. respondents had to answer each question before they were allowed to proceed to the next question) was used to prevent missing answers [10]. Via patient-specific codes assigned to each survey, the response rate per primary care center was checked and reported back to each center once a week during the data collection period.

Measures

Sociodemographic data. Several sociodemographic information was collected through the online survey (gender, age, marital status, and work status).

Health-related Quality of Life. Health-related Quality of Life was assessed using the EQ-5D-3L. The EQ-5D is a validated instrument consisting of 5 subscales (mobility/ self-care/ usual activities/ pain-discomfort/ anxiety-depression) with 3 response levels and a visual analogue scale (EQ-VAS) that evaluates health status between 0 (worst imaginable health) and 100 (best imaginable health). We used the Dutch Time Trade-Off (TTO) value set [29] to calculate the TTO score. The EQ-5D-3L Dutch TTO preference value ranged from - 0.33 to 1.00 [29].

Integrated care. The Rainbow Model of Integrated Care Measurement Tool (RMIC-MT) patient version measures the extent to which patients experience the integration of care [10, 30]. The 16-item survey consists of 4 subscales representing domains of the RMIC from a patient perspective: 1) person-centeredness (2 items, e.g. needs assessment), clinical coordination (6 items, e.g. personal care plan), professional coordination (4 items, e.g. multidisciplinary team), and organisational coordination (4 items, e.g. inter-organisational partnership). Patients rate each item on a 5-point Likert scale indicating how they experience the coordination, ranging from poor (1) to very good (5). Ratings are averaged to yield subscale scores and an overall summary score. The RMIC-MT is a validated questionnaire used in previous primary care studies [31-36].

Statistical Analysis

Descriptive statistics were used to summarize the patients' characteristics, HRQOL, TTO, and RMIC-MT scales. The mean and standard deviation were reported for age, utility, HRQOL, and RMIC-MT scales. Frequencies and percentages were used for categorical variables. The Cronbach's Alpha was calculated for the RMIC-MT subscales to asses internal consistency. The Chi-square test was used to evaluate proportional difference in categorical variables. The Mann-Whitney nonparametric test was used for between group differences. Both bivariate and multivariate logistic regression analyses were used to assess the association between the 4 subscales of the RMIC-MT and HRQOL. The dimensions of the EQ-5D-3L were dichotomised by grouping severity levels 2 (some problems) and 3 (extreme problems) as poor HRQOL, and assigning severity level 1 (no problem) good HRQOL [26]. In addition, the TTO score was dichotomised as good (i.e. $\geq \mu$) and poor (i.e. $< \mu$, reference category) HRQOL groups based on the mean TTO score. All variables with $p \leq 0.2$ in the bivariate analysis were included in the multivariate analysis because of the explorative nature of this study. Significance of the variables was assessed by the p-values (< 0.05), odds ratios (OR) and 95 % confidence intervals (CI) for association between RMIC-MT subscale scores and HRQOL. The Hosmer-Lemeshow goodness-of-fit statistic with p-value above 0.05 was considered a well-fitting regression model, and the percentage of the variability predicted by the model is explained by the Nagelkerke R^2 [37]. Data analyses were performed using SPSS version 23.0 (IBM SPSS Statistics, 2015).

Ethics

Participation in this study was on a voluntary basis. Participants signed a written informed consent form that included providing permission to record data for research and publication purposes in an anonymized manner. No further research ethics approval was needed because

the study was considered noninterventional according to the Dutch Medical Research and Human Subjects Act (WMO).

Patient and public involvement

Patients and the public were not involved in the design of the study, or in the recruitment of the study. Results were disseminated through a local focus group and the website of the participating GP practices.

Results

Study sample

A total of 933 respondents participated (20.2 % response rate) in this study. The mean age of the participants was 62.1 (14.4) years old, and 54.7 % of the sample were female. The majority of the participants were married (70.3 %) and almost half of them (49 %) were retired from work. Of the participants, 449 were categorised in the high HRQOL group (58.3 %) and the remaining 321 were in the low HRQOL group (41.7%). There was a statistically significant difference in gender ($p < 0.0001$) marital ($p = 0.001$) and work ($p < 0.0001$) status between HRQOL groups. Especially unemployment (20.7 %) was high in the low HRQOL group compared to those in the high HRQOL group (4.6 %). Furthermore, respondents in the high HRQOL group experienced a better overall care coordination ($p = 0.011$). Respondents in the high HRQOL group were more satisfied with the professional ($p = 0.039$) and organisational ($p = 0.002$) coordination activities compared to those in the low HRQOL group. The respondents' characteristics in the low and high HRQOL group are listed in Table 1.

[Insert Table 1]

Health Related Quality of Life
The proportion of respondents reporting a problem in one of the five dimensions of the EQ-5D is reported in Table 2. The most health problems (47 %) were experienced within the 'pain/

discomfort' dimension, where 44.1 % of the respondents had moderate problems and 2.9 %

severe problems. The second most problems (22.6 %) were experienced within the 'usual

activity' domain, where 21% of the respondents indicated a moderate health problem and 1.6

% a severe health problem. The least referred dimension (3.6 %) was 'self-care', with 3.5 %

moderate and 0.1 % severe health problems being reported. When comparing the low and high

HRQOL groups, 85.7 % of the people in the low HRQOL group reported moderate to severe

health problems in the 'pain/ discomfort' dimension, 59.8 % in the 'usual activity' dimension,

and 54.2 % in the 'mobility' dimension (see Table 2).

[Insert Table 2]

Integrated service delivery and HRQOL

Table 3 shows the results of the bivariate and multivariate logistic regression analysis of the

integrated care variables with the five HRQOL dimensions and group scores. The bivariate

analysis demonstrated that age and unemployment was associated with statistically significant

increases in the odds of reporting any problem in the HRQOL dimensions. No relation appeared

between age and overall HRQOL group score (OR = 1.0, 95 % CI 0.99 - 1.01, p = 0.49). For

married people, the odds were higher to report any problem in the dimensions anxiety/

depression (OR=2.27, 95% CI 1.58-3.26, p < 0.0001), and usual activity (OR=1.26, 95% CI

0.90-1.75, p = 0.18), and overall low HRQOL (OR=0.57, 95% CI 0.42-0.79, p < 0.001).

A better organizational care coordination experience increased the odds of a better HRQOL

(OR = 1.72, 95 % CI 1.24 - 2.39, p = 0.001), and reporting no health problems in the anxiety/

depression (OR = 0.43, 95 % CI 0.29 - 0.64, p < 0.0001), pain discomfort (OR = 0.71, 95 % CI

0.53 - 0.94, p = 0.019), and usual activities (OR = 0.58, 95% CI 0.41 - 0.82, p = 0.002)

dimensions. Similar findings were observed for a better professional coordination experience

where the odds increased for reporting a better overall HRQOL (OR = 1.48, 95% CI 1.13 - 1.96,

p = 0.005), and less health problems in the anxiety/ depression (OR = 0.64, 95% CI 0.46 - 0.89,

p = 0.007) and pain discomfort (OR = 0.69, 95% CI 0.54 - 0.89, p = 0.003) domain. Finally, people who experienced better clinical care coordination had increased odds of reporting less problems in the usual activity dimension (OR = 0.76, 95% CI 0.59 - 0.97, p < 0.026).

The multivariate logistic regression analysis confirmed that the odds of reporting any HRQOL problem were significantly higher for unemployed people (see Table 3). People who were married were less likely to report any problem of anxiety/ depression (OR = 0.47, 95% CI 0.31 - 0.72, p < 0.0001) and a better overall HRQOL (OR = 1.60, 95% CI 1.13 - 2.26, p = 0.008). Aging increased the odds of reporting problems in the mobility (OR = 1.06, 95% CI 1.04 - 1.09, p < 0.0001), self-care (OR = 1.06, 95% CI 1.02 - 1.11, p = 0.004), usual activities (OR = 1.03, 95% CI 1.01 - 1.05, p = 0.001) and pain and discomfort (OR = 1.02, 95% CI 1.01 - 1.04, p = 0.007) domains. Being female increased the odds of reporting problems in the pain and discomfort domain (OR = 1.47, 95% CI 1.11 - 1.95, p = 0.008).

A better organizational coordination experience increased the odds of an higher overall HRQOL (OR = 1.87, 95% CI 1.18 - 2.95, p = 0.007) and reporting less health problems in the anxiety/ depression domain (OR = 0.36, 95% CI 0.20 - 0.63, p < 0.0001). For person-centeredness, clinical coordination and professional coordination no significant relation with HRQOL was found. The Hosmer-Lemeshow goodness-of-fit test p-values ranged between 0.35 and 0.81, suggestive of well-fitting models. The variability explained ranged from 6 % for the pain/discomfort model (Nagelkerke R^2 = 0.06) to 16 % for the mobility, self-care, and anxiety/ depression models (Nagelkerke R^2 = 0.16), see Table 3.

[Insert Table 3]

Discussion
Principle findings

This study showed that patients who experienced a better organizational coordination where more likely to report a higher overall HRQOL and less anxiety and depression problems. No

association between person-centred, clinical and professional coordination experiences and HRQOL in a general primary care practice population were found. Unemployment was associated with poorer overall HRQOL, and aging was associated with mobility, self-care, usual activity and pain problems. Also, female patients were more likely to report pain and discomfort problems. On the other hand, patients who were married reported less anxiety and depression problems.

Comparison with other studies

This is, to our knowledge, the first study to evaluate the association between integrated care and HRQOL in a general primary care practice population. Previous studies on integrated care and HRQOL have mainly focused on patient groups with specific chronic diseases [38], older populations [39] or on multimorbidity populations [40]. Furthermore, existing studies tend to lack a coherent theory and solid psychometric measurement tools to compare integrated care programs.

The results of the current study show a clear relationship between organisational coordination activities and HRQOL among adult patients in a general primary care practice context. To the contrary, earlier studies focused mainly on interventions aimed at coordinating care at the clinical (e.g. self-management) and professional (e.g. multidisciplinary care) levels [9, 10, 39]. As such, it is possible to infer that patients in a primary care context may have a potential to gain in HRQOL if GPs devise efforts to improve the inter-organisational aspects of their integrated care programs. Previous research has indicated the lack of organizational capacity of Dutch primary care practices [5]. No relation between clinical and professional coordination and HRQOL was observed in the present study, which seems to be inconsistent with previous studies [14, 17, 18, 40, 41]. This discrepancy may be due to the fact that clinical and professional coordination have more influence on the perceived HRQOL of people with a chronic disease whereas in this study the entire primary care practice population was included.

Therefore, information linking organisation coordination to improved HRQOL is hypothesis-generating and requires conformation in further studies. Similarly, a person-centred care approach was not association with HRQOL in this study, while aspects related to knowing and addressing patients' physical, psychological and social needs is considered an essential aspect of primary care service delivery [6, 20]. This could be explained by the complexity of needs of the patients in previous studies with (multiple) chronic conditions, who require more tailored person-centred approaches in the clinical encounter as compared to the general population which was included in this study. Therefore, further work is still required to explore the association between person-centred care experiences and HRQOL in different patient groups.

As could be expected from previous studies [23-26], unemployment was associated with a poorer HRQOL. This implicates that integrated care programs have to take into account through social policies aspects like loneliness and financial constraints in order to have an impact on the quality of life of people in local communities. Aging was also associated with more mobility, self-care, usual activities and pain and discomfort problems, which is consistent with previous research [21, 22]. However, no effect of aging was observed on overall HRQOL. This inconsistency could be related to the sample composition; in the present study the entire primary practice population was included whereas previous studies were limited to chronic disease populations. The present study also corroborates that being female heightened the change of a lower HRQOL[22, 26], especially evaluating the change to experience pain and discomfort problems. The current results showed that married participants had a higher overall HRQOL and reported less anxiety and depression problems compared to singles, this is in accordance with a previous primary care study [25]. As such, GPs participating in integrated care programs should be aware of possible accumulation of these risk factors, notably women living alone and who are unemployed. To further understand the relationship between integrated care and HRQOL and these sociodemographic determinants more research is needed.

Strengths and limitations of this study

The strength of the present study is that it was grounded theoretically on the RMIC. The explored association between integrated care and HRQOL was based on preliminary evidence also grounded on the RMIC [5, 6, 10, 31-36]. Since thorough research into the effects of integrated care at organisational levels is scarce [10], this study is a unique and valuable contribution to existing knowledge of integrated primary care. Potentially boosting the external validity of our findings was the use of a cross-sectional design in a general primary care practice population. With regard to the used measures, firstly HRQOL was measured using the EQ-5D: a generic measure which is applicable in a general practice population. The EQ-5D has a good construct validity and is simpler and briefer than other HRQOL measures [42]. Secondly, the RMIC-MT patient version is considered a brief, reliable, and validated measurement tool to measure integrated care in routine practice [10]. The RMIC-MT patient version is also considered to be the most comprehensive patient experience measure which assesses all essential aspects of integrated care [36].

This study has several limitations. First, due to the cross-sectional nature of our study the direction of the association between integrated care and HRQOL cannot be established. Moreover, it is unclear if differences in integrated care scores reflect actual differences in care delivery or differences in the perception of care [9]. For this reason a follow-up study will be beneficial to explore and deepen the understanding of the associations. A second limitation is caused by the unavailability of routine health data. As such, it was not possible to account for other factors (e.g. number of chronic diseases) that might be associated with perceptions of care delivery and quality of life. Our study was conducted among the general primary care practice population, the logical next step would be to replicate these analyses by exploring in depth the sociodemographic, care integration and health data of people with a low HRQOL. Accordingly, future studies should consider other outcome measures (e.g. service use, satisfaction, quality of care) as well as potential effect modifiers of integrated care to explore the peculiarities of their

relationship with HRQOL. For example, socio-economic factors like employment and marital status were related to some investigated variables. Third, our findings are limited by selection bias inherent to the convenience sample of patients that participated in this study. The participating primary care practices are restricted to a narrow geographical region in The Netherlands. Moreover, the response rate of the present study is relatively low compared to other patients surveys studies in The Netherlands[27], which might have resulted in underestimation or overestimation of our results. Nevertheless, the results generated from this relatively small sample will be useful to validate studies with a large sample.

Implications for practice

The association between organisational integration and perceived quality of life found in this study could be considered a first step forward to improve the inter-organisational capacity of primary care practices. These findings reinforce the necessity of long-term policy and incentives to enhance integrated primary care teams to meet the care needs of people in local communities in the Netherlands. Further studies with a longitudinal design are needed to evaluate the effect of integrated care activities within primary care services on HRQOL measures. Moreover, future studies on the effectiveness of integrated care interventions must consider local contextual characteristics' of the studied population by uniting realist with reductionist evaluation designs (e.g. realist RCTs) [9]. Often the context in which integrated care interventions are implemented are overlooked. These studies are crucial as it will allow policy makers to tailor the choice of interventions to the desired outcome, available resources, and local health-care context.

Conclusion

This is the first study that explores the association between integrated care and HRQOL from the perspective of patients of a primary care practice population. The present study showed that

patients with a better organizational care coordination experience where more likely to have a higher HRQOL. Unemployment and aging were associated with lower HRQOL, and people who were married reported less anxiety and depression problems. Our findings underscore the importance of enhancing the inter-organisational capacity of primary care practice when planning interventions to improve HRQOL of people in a local community.

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Authors Contributions

Authors contributions were as follows. Study concept and design: PV; Acquisition, analysis, and interpretation of the data: PV and MK; Drafting of the manuscript: PV; Critical revision of the manuscript for important intellectual content: PV, MK, JH, RA; Statistical analysis: PV and MK; Study supervision: PV and RA. All authors read and approved the final manuscript. PV and MK had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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Competing interests

The authors declare that they have no competing interests.

Data sharing statement

No additional data available.

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Figures
Figure 1: The Rainbow Model of Integrated Care (RMIC)

Adapted with permission from Essenburgh Research & Consultancy [43].

Tables
Table 1. Respondents' characteristics in the low and high HRQOL group

Variable	Low HRQOL group [a]	High HRQOL group [b]	Total	*P*
Sample size, n (%)	321 (41.7)	449 (58.3)	770 (100)	NS
Gender, n (%)[*]				
Male	121 (37.7)	228 (50.8)	349 (45.3)	<0.0001
Female	200 (62.3)	221 (49.2)	421 (54.7)	
Age (years), mean (SD)[±]	62.55 (15.64)	62.83 (13.43)	62.1 (14.4)	0.255
Marital status, n (%)[*]				
Married	204 (63.6)	334 (75.2)	538 (70.3)	0.001
Single	117 (36.4)	110 (24.8)	227 (29.7)	
Work status, n (%)[*]				
Employed	89 (30.3)	200 (46.4)	289 (39.9)	<0.0001
Unemployed	61 (20.7)	20 (4.6)	81 (11.2)	
Retired	144 (49)	211 (49)	355 (49)	
Integrated care, mean (SD)[±]				
Integrated care (RMIC-MT total)	3.68 (0.46)	3.77 (0.41)	3.73 (0.44)	0.011
Person-centeredness	3.23 (0.79)	3.30 (0.67)	3.27 (0.73)	0.329
Clinical coordination	4.05 (0.62)	4.11 (0.59)	4.09 (0.61)	0.201
Professional coordination	3.29 (0.57)	3.40 (0.49)	3.35 (0.54)	0.039
Organisational coordination	3.83 (0.46)	3.94 (0.44)	3.90 (0.46)	0.002
HRQOL, mean (SD)[±]				
TTO	0.70 (0.18)	0.99 (0.19)	0.86 (0.19)	<0.0001
EQ-VAS	64.29 (19.89)	85.94 (13.62)	76.91 (19.66)	<0.0001

Abbreviations: NS, not stated; HRQOL, Health related Quality of Life; RMIC-MT, Rainbow Model of Integrated Care

Measurement Tool; TTO, Time Trade-Off.

[a] TTO score < 0.86

[b] TTO score ≥ 0.86

[*] Chi-square test

[±] Mann-Whitney test

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Table 2. Distribution of responses among the HRQOL dimensions split for the low and high HRQOL groups

Dimension	Level[#]	Low HRQOL group [a]	High HRQOL group [b]	Total	*P*
Mobility, n (%)[*]	1	147 (45.8)	427 (95.1)	735 (78.8)	<0.001
	2	171 (53.3)	22 (4.9)	195 (20.9)	
	3	3 (0.9)	0 (0.0)	3 (0.3)	
Self-care, n (%)[*]	1	289 (90)	449 (100)	899 (96.4)	<0.001
	2	31 (9.7)	0 (0.0)	33 (3.5)	
	3	1 (0.3)	0 (0.0)	1 (0.1)	
Usual activity, n (%)[*]	1	129 (40.2)	432 (96.2)	722 (77.4)	<0.001
	2	179 (55.8)	17 (3.8)	196 (21)	
	3	13 (4.0)	0 (0.0)	15 (1.6)	
Pain/discomfort, n (%)[*]	1	46 (14.3)	449 (100)	495 (53.1)	<0.001
	2	250 (77.9)	0 (0.0)	411 (44.1)	
	3	25 (7.8)	0 (0.0)	27 (2.9)	
Anxiety/depression, n (%)[*]	1	173 (2.2)	449 (100)	783 (83.9)	<0.001
	2	141 (43.9)	0 (0.0)	141 (15.1)	
	3	7 (2.2)	0 (0.0)	9 (1)	

[#] Level definitions (1 no problem, 2 some/moderate problem and 3 extreme problem).

[a] TTO score < 0.86

[b] TTO score ≥ 0.86

[*] Chi-square test

Table 3. Bivariate and multivariate logistic regression analysis between integrated care and HRQOL

Variable	Mobility				Self-Care				Usual activities				Pain/discomfort				Anxiety/depression				TTO groups			
	Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Gender																								
Male	1		NA	NA	1		NA	NA	1		NA	NA	1		1		1		1		1		1	
Female	0.997 (0.73-1.37)	0.983	NA	NA	1.573 (0.79-3.14)	1.198	NA	NA	0.840 (0.62-1.15)	0.272	NA	NA	0.679 (0.52-0.88)	0.004	1.469 (1.11-1.95)	0.008	0.619 (0.43-0.89)		1.227 (0.81-1.87)	0.339	1.705 (1.27-2.28)	<0.001	0.67 (0.48-0.93)	0.016
Age (years)	1.056 (1.04-1.07)	<0.001	1.062 (1.04-1.09)	<0.001	1.047 (1.02-1.08)	0.002	1.061 (1.02-1.11)	0.004	1.014 (1.00-1.03)	0.014	1.034 (1.012-1.05)	0.001	1.008 (1.00-1.02)	0.086	1.022 (1.01-1.04)	0.007	0.980 (0.97-0.99)		1.002 (0.98-1.02)	0.829	0.997 (0.99-1.01)	0.493	NA	NA
Marital status																								
Single	1		NA	NA	1		NA	NA	1		1		1		NA	NA	1		1		1		1	
Married	1.175 (0.837-1.65)	0.353	NA	NA	1.198 (0.58-2.49)	0.628	NA	NA	1.258 (0.90-1.75)	0.176	1.31 (0.90-1.90)	0.157	1.195 (0.90-1.90)	0.219	NA	NA	2.271 (1.58-3.26)	<0.001	0.472 (0.31-0.72)	<0.001	0.574 (0.42-0.79)	0.001	1.598 (1.13-2.26)	0.008
Work status																								
Employed	1		1		1		1		1		1		1		1		1		1		1		1	
Unemployed	4.102 (2.30-7.33)	<0.001	4.311 (2.35-7.96)	<0.001	25.314 (5.50-116.49)	<0.001	24.849 (5.33-115.87)	<0.001	7.858 (4.67-13.22)	<0.001	8.426 (4.88-14.54)	<0.001	2.998 (1.84-4.88)	<0.001	2.834 (1.71-4.70)	<0.001	5.998 (3.56-10.10)	<0.001	5.625 (3.24-9.76)	<0.001	0.146 (0.08-0.26)	<0.001	0.152 (0.08-0.28)	<0.001
Retired	4.236 (2.80-6.41)	<0.001	1.325 (0.74-2.36)	0.346	7.939 (1.83-34.45)	0.006	2.44 (0.46-12.83)	0.291	2.218 (1.51-3.25)	0.002	1.13 (0.66-1.93)	0.656	1.355 (1.02-1.80)	0.036	0.924 (0.60-1.41)	0.716	0.936 (0.61-1.44)		0.905 (0.49-1.67)	0.750	0.652 (0.47-0.91)	0.010	0.590 (0.42-0.83)	0.002
Integrated care																								

Variable	Mobility Univariate OR (95% CI)	P	Mobility Multivariate OR (95% CI)	P	Self-Care Univariate OR (95% CI)	P	Self-Care Multivariate OR (95% CI)	P	Usual activities Univariate OR (95% CI)	P	Usual activities Multivariate OR (95% CI)	P	Pain/discomfort Univariate OR (95% CI)	P	Pain/discomfort Multivariate OR (95% CI)	P	Anxiety/depression Univariate OR (95% CI)	P	Anxiety/depression Multivariate OR (95% CI)	P	TTO groups Univariate OR (95% CI)	P	TTO groups Multivariate OR (95% CI)	P
Person-centeredness	0.939 (0.76-1.17)	0.568	NA	NA	1.210 (0.75-1.95)	0.431	NA	NA	0.844 (0.68-1.04)	0.114	0.979 (0.73-1.31)	0.884	0.862 (0.72-1.03)	0.100	0.98 (0.78-1.24)	0.90	0.853 (0.67-1.08)	0.171	1.236 (0.89-1.72)	0.209	1.153 (0.95-1.41)	0.16	0.913 (0.70-1.20)	0.51
Clinical coordination	0.831 (0.64-1.07)	0.154	1.021 (0.72-1.45)	0.908	0.749 (0.44-1.28)	0.290	NA	NA	0.764 (0.59-0.97)	0.026	1.007 (0.71-1.43)	0.968	0.845 (0.68-1.05)	0.122	1.010 (0.76-1.34)	0.94	0.760 (0.57-1.01)	0.055	1.326 (0.88-1.97)	0.176	1.188 (0.94-1.51)	0.154	0.850 (0.61-1.19)	0.34
Professional coordination	1.004 (0.75-1.34)	0.976	NA	NA	1.242 (0.66-2.34)	0.501	NA	NA	0.772 (0.58-1.03)	0.077	0.982 (0.66-1.45)	0.927	0.694 (0.54-0.89)	0.003	0.82 (0.61-1.13)	0.225	0.637 (0.46-0.89)	0.007	0.854 (0.54-1.35)	0.498	1.484 (1.13-1.96)	0.005	1.173 (0.81-1.71)	0.40
Organisational coordination	0.722 (0.51-1.02)	0.064	0.777 (0.49-1.23)	0.278	0.703 (0.34-1.47)	0.35	NA	NA	0.58 (0.41-0.82)	0.002	0.643 (0.40-1.05)	0.076	0.710 (0.53-0.94)	0.019	0.792 (0.54-1.17)	0.243	0.430 (0.29-0.64)	<0.001	0.356 (0.20-0.63)	<0.001	1.720 (1.24-2.39)	0.001	1.869 (1.18-2.95)	0.007
Hosmer & Lemeshow	NA		0.49		NA		0.66		NA		0.62		NA		0.81		NA		0.76		NA		0.35	
Cox & Snell's R^2	NA		0.10		NA		0.04		NA		0.09		NA		0.05		NA		0.10		NA		0.11	
Nagelkerke R^2	NA		0.16		NA		0.16		NA		0.14		NA		0.06		NA		0.16		NA		0.14	

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For peer review only

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

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		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	2
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	#4	Present key elements of study design early in the paper	6

Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	6
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	7
Bias	#9	Describe any efforts to address potential sources of bias	14
Study size	#10	Explain how the study size was arrived at	6
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	7
Statistical methods	#12c	Explain how missing data were addressed	7
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	7
Statistical methods	#12e	Describe any sensitivity analyses	8

Results

| Participants | #13a | Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable. | 8 |

Participants	#13b	Give reasons for non-participation at each stage	8
Participants	#13c	Consider use of a flow diagram	NA
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	9
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	NA
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	9
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10
Main results	#16b	Report category boundaries when continuous variables were categorized	NA
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	11

Discussion

Key results	#18	Summarise key results with reference to study objectives	11
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	13
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14

Other Information

Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

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A cross-sectional study evaluating the association between integrated care and health-related quality of life (HRQOL) in Dutch primary care

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A cross-sectional study evaluating the association between integrated care and health-related quality of life (HRQOL) in Dutch primary care

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Number of words: 3826.

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19 # Abstract

20 # Objectives

21 The aim of this study was to evaluate the association between integrated care and health-related

22 quality of life (HRQOL) in a primary care practice population.

23 # Design

24 A cross-sectional survey study.
25

26 # Setting
27
28 Primary care practice population.

29

30 # Participants
31
32 A sample (n= 5.562) of patients in two general practitioner (GP) practices in the Netherlands.

33

34 # Primary outcome measures
35 The Rainbow Model of Integrated Care Measurement Tool (RMIC-MT) patient version and

36 EQ-5D was used to assess integrated service delivery and HRQOL. The association between

37 integrated care and HRQOL groups was analysed using multivariate logistic regression.

38

39 # Results

40 Overall, 933 respondents with a mean age of 62 participated (20% response rate) in this study.

41 The multivariate analysis revealed that positive organisational coordination experiences were

42 linked to better HRQOL (OR = 1.87, 95% CI 1.18 - 2.95), and less anxiety and depression

43 problems (OR = 0.36, 95% CI 0.20 - 0.63). Unemployment was associated with a poor HRQOL

44 (OR = 0.15, 95% CI 0.08 - 0.28). Aging was associated with more mobility (OR = 1.06, 95%

45 CI 1.04 - 1.09), self-care (OR = 1.06, 95% CI 1.02 - 1.11), usual activity (OR = 1.03, 95% CI

46 1.01 - 1.05) and pain problems (OR = 1.02, 95% CI 1.01 - 1.04). Being married improved the

47 overall HRQOL (OR = 1.60, 95% CI 1.13 - 2.26), and decreased anxiety and depression (OR

48 = 0.47, 95% CI 0.31 - 0.72). Finally, females had a poor overall HRQOL (OR = 1.67, 95% CI

49 0.48 - 0.93) and more pain and discomfort problems (OR = 1.47, 95% CI 1.11 - 1.95).

Conclusion

51 This study shows for the first time that organizational coordination activities are positively

52 associated with HROQL of adult patients in a primary care context, adding to the evidence of

53 an association between integrated care and HRQOL. Also, unemployment, aging and being

54 female are accumulating risk factors that should be considered when designing integrated

55 primary care programs. Further research is needed to explore how various integration types

56 relate to HRQOL for people in local communities.

Key words

58 Integrated care, care coordination, triple aim, primary care, health-related quality of life, the

59 Netherlands; survey

Strengths and limitations of this study

61 • This is the first study to assess the relationship between integrated care and health-related

62   quality of life (HRQOL) in a primary care practice population based on the Rainbow Model

63   of Integrated Care (RMIC) theory.

64 • The analysis identified that organisational integration was positively associated with

65   HROQL.

66 • Due to the cross-sectional study design, the causal relationship between integrated care and

67   HRQOL and influencing factors require further exploration.

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69 # Introduction

70 Primary care is considered the cornerstone for integrating health and social services for people

71 in local communities [1]. It is also the first level of care where health is promoted and disease

72 prevented. In countries with a strong primary care system, such as the Netherlands, general

73 practitioners (GPs) provide person-centred continuous care to people in local communities. GPs

74 often collaborate with practice nurses, community pharmacists, medical specialists and home

75 care teams to deliver integrated care (i.e,. in care groups, community health centres, bundled

76 payments, subsidies programs). Yet, the coordination of care between these providers is

77 considered to be insufficient in the Netherlands, leading to fragmented care delivery [2]. There

78 is a growing concern about the lack of a coherent long-term policy to enhance the organization

79 of integrated primary care services that ensure all citizens quality of and access to care [3-5].

80 For this study, we used the Rainbow Model of Integrated Care (RMIC) to analyse the

81 extent of care integration. The RMIC provides a theoretical framework for describing the four

82 types of integration aimed at coordinating care at the clinical (e.g. self-management, case

83 management), professional (e.g. multidisciplinary care, continuity of care), organizational (e.g.

84 disease management, managed care programs) or system (e.g. healthcare policies and

85 regulations) levels [6]. The enablers describe the functional (e.g. IT, financial incentives) and

86 normative (e.g. cultural values) integration mechanisms necessary to integrate care at various

87 levels (see Figure 1). The RMIC provides a theoretical basis to understand the multi-layered

88 relationships of various types of integration and enables empirical approaches to assess

89 integrated care. Furthermore, the RMIC provides theoretically informed hypotheses on how

90 various integration types may or may not lead to improved health outcomes of the 'Triple Aim'

91 of patient care experience, and efficiency and costs [7]. The underlying assumption is that a

92 significant impact on clinical, quality of care, and economic outcomes requires various

93 interacting interventions targeted at the clinical, professional, organisational, and system levels

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94 [8]. Based on the RMIC, we define integrated care as *a coordinated way of working across*

95 *multiple professionals, organisations, and sectors in order to improve the health, quality of*

96 *care, and economic outcomes for a targeted (sub)population.*

97   However, firm conclusions regarding the effects of integrated primary care on Triple

98 Aim outcomes cannot be made, due to the lack of rigorous long-term evaluation programs [8,

99 9]. In addition, empirical evidence on whether the impact on these outcomes might differ

100 between these integrated care levels is lacking [9, 10]. Most existing studies focus on integrated

101 primary care interventions at the clinical level, while interventions targeted at meso

102 organisational integration and macro system levels are scarce. As a result, few integrated

103 primary care models are widely implemented (e.g. patient-centred medical homes, accountable

104 care organisations, community care groups), and the current net benefit of integrated primary

105 care and how outcomes are achieved remains partly unknown [5, 11-13].

106   There is a need to determine if integrated care approaches produce better health status

107 outcomes within primary care contexts. In this context, HRQOL can be considered as an

108 indicator by which patients express their views and perceptions about their health status, which

109 measures the effect integrated primary care has on them. Several reviews have shown positive

110 effects of integrated care on HRQOL of people with chronic diseases like diabetes [14, 15],

111 heart failure [16], depression [17] and chronic obstructive pulmonary disease [18, 19]. Although

112 this knowledge is valuable, a disease-focused approach is considered dysfunctional in primary

113 care, given that general practitioners' practices consists of a wide range of patients with vastly

114 different socio-demographics and health problems [6, 20]. Specifically, the essence of primary

115 care is to provide person-focused rather than disease-focused care [6, 20]. Yet, published

116 studies describing the content and impact of integrated care models on HRQOL in a general

117 primary care patient population are lacking. Patient-level HRQOL is essential for monitoring

118 integrated primary care and designing improvement programs. In order to design effective

119   integrated primary care programmes for (sub)populations, information on the relationship

120   between integrated care, HRQOL and sociodemographic characteristics is needed. Factors like

121   aging [21, 22], unemployment [23, 24], marital status [25], gender [22, 26] and comorbidities

122   [21, 22, 25] have been found to affect HRQOL within a primary care context. Thus, these

123   sociodemographic factors should be taken into account when developing integrated care

124   programs to understand which patients are most likely to respond to different types of integrated

125   care interventions.

126   In view of the above, this study aimed to assess the relation between integrated care and

127   HRQOL of patients in primary care practices in a community setting. Based on the RMIC we

128   hypothesize that an improved overall integrated care experience is positively associated with a

129   better HRQOL. The following research objectives were posed:

130   1. To examine the association between integrated care and HRQOL in a primary care practice

131   population.

132   2. To examine the association between sociodemographic (gender, age, employment and

133   marital status) characteristics and HRQOL in a primary care practice population.

134   [Insert Figure 1]

Methods

136   The present study used a cross-sectional survey design exploring the relationship between

137   integrated care and HRQOL in 4,624 individuals registered in two primary care centres in an

138   urban region in the Netherlands, between June and July 2019.

Participants

140   Participants in this study were registered in two primary care centres in Brummen (n=1.854)

141   and Eerbeek (n=2.770). Since 2006, approximately 80% of all primary care practices in the

142   Netherlands have delivered integrated care programs for several chronic conditions (e.g.

143   diabetes, cardio-vascular risk, chronic obstructive pulmonary disease (COPD), depression, frail

144   elderly etc.) [27]. Both primary care centres included in this study delivered these integrated

145   care programs.

146   Participants were eligible to participate when they were 18 years or older. Participants

147   that were unable or unwilling to provide informed consent were excluded from the study. The

148   sample size method for an unknown population was used to calculate the sample size, which

149   was estimated to be 963 respondents (481 from each primary care center) according to a

150   standardized medium effect size of 0.3 [28], α error probability of 0.05, power (1−β error

151   probability) of 0.95 and 30 % response rate [29] using the GPower version 3.1.9.2 [30].

Procedure

153   Participating primary care centers received a written information package consisting of an

154   introduction letter and patient information sheet to inform care providers and patients about the

155   study's purpose and data collection methods. Participants were asked to complete digital

156   informed consent before enrolment in the study. A hyperlink to a web-based survey platform

157   was sent by email, and two reminders were sent to the participants by email. A forced answering

158   procedure (i.e. respondents had to answer each question before they were allowed to proceed

159   to the next question) was used to prevent missing answers [10]. Patient-specific codes were

160   assigned to each survey, and the response rate per primary care center was checked and reported

161   back to each center once a week during the data collection period.

Measures

163
164   *Sociodemographic data.* Several sociodemographic information was collected through

165   the online survey (gender, age, marital status, and work status).

166   *Health-related Quality of Life*. Health-related Quality of Life was assessed using the

167   EQ-5D-3L, which is a validated instrument consisting of five subscales (mobility, self-care,

168   usual activities, pain-discomfort, anxiety-depression) with three response levels and a visual

169   analogue scale (EQ-VAS) that evaluates health status between 0 (worst imaginable health)

170 and 100 (best imaginable health). We used the Dutch Time Trade-Off (TTO) value set [31] to

171 calculate the TTO score. The EQ-5D-3L Dutch TTO preference value ranged from -0.33 to

172 1.00 [31].

173   *Integrated care*. The Rainbow Model of Integrated Care Measurement Tool (RMIC-

174 MT) patient version measures the extent to which patients experience the integration of care

175 [10, 32]. The 16-item survey consists of four subscales representing domains of the RMIC from

176 a patient perspective: person-centeredness (2 items, e.g. needs assessment), clinical

177 coordination (6 items, e.g. personal care plan), professional coordination (4 items, e.g.

178 multidisciplinary team), and organisational coordination (4 items, e.g. inter-organisational

179 partnership). Patients rate each item on a 5-point Likert scale indicating how they experience

180 the coordination, ranging from poor (1) to very good (5). Ratings are averaged to yield subscale

181 scores and an overall summary score. The RMIC-MT is a validated questionnaire used in

182 previous primary care studies [33-38].

Statistical Analysis

184 Descriptive statistics were used to summarize the patients' characteristics, HRQOL, TTO, and

185 RMIC-MT scales. The mean and standard deviation were reported for continuous variables

186 such as age, utility, HRQOL, and RMIC-MT scales. Frequencies and percentages were used

187 for categorical variables. Cronbach's Alpha was calculated for the RMIC-MT subscales to asses

188 internal consistency. The Chi-square test was used to evaluate proportional difference in

189 categorial variables. The Mann-Whitney nonparametric test was used for between group

190 differences. Both bivariate and multivariate logistic regression analyses were used to assess the

191 association between the four independent continuous subscales of the RMIC-MT and the

192 dependent ordinal HRQOL variables. The dimensions of the EQ-5D-3L were dichotomised by

193 grouping severity levels 2 (some problems) and 3 (extreme problems) as poor HRQOL, and

194 assigning severity level 1 (no problem) as good HRQOL [26]. In addition, the TTO score was

195 dichotomised as good (i.e. $\geq \mu$) and poor (i.e. $< \mu$, reference category) HRQOL groups based

196 on the mean TTO score. All variables with $p \leq 0.2$ in the bivariate analysis were included in the

197 multivariate analysis because of the explorative nature of this study. Significance of the

198 variables was assessed by the p-values (< 0.05), odds ratios (OR) and 95 % confidence intervals

199 (CI) for associations between RMIC-MT subscale scores and HRQOL. The Hosmer-Lemeshow

200 goodness-of-fit statistic with p-value above 0.05 was considered a well-fitting regression

201 model, and the percentage of the variability predicted by the model is explained by the

202 Nagelkerke R^2 [39]. Data analyses were performed using SPSS version 23.0 (IBM SPSS

203 Statistics, 2015) and the statistical software package R (http://www.R-project.org, The R

204 Foundation).

Ethics

206 Participation in this study was on a voluntary basis. Participants signed a written informed

207 consent form that included providing permission to record data for research and publication

208 purposes in an anonymized manner. No further research ethics approval was needed because

209 the study was considered noninterventional according to the Dutch Medical Research and

210 Human Subjects Act (WMO).

Patient and public involvement

212 Patients and the public were not involved in the design of the study, or in the recruitment of the

213 study. Results were disseminated through a local focus group and the website of participating

214 GP practices.

Results

Study sample

217 A total of 933 respondents participated (20.2 % response rate) in this study. The mean age of

218 the participants was 62.1 (14.4) years, and 54.7 % of the sample were female. The majority of

219   the participants were married (70.3 %) and almost half (49 %) were retired. Of the participants,

220   449 were categorised in the high HRQOL group (58.3 %) and the remaining 321 were in the

221   low HRQOL group (41.7%). There was a statistically significant difference in gender ($p <$

222   0.0001) marital status ($p = 0.001$) and work status ($p < 0.0001$) between HRQOL groups.

223   Unemployment (20.7 %) was especially high in the low HRQOL group compared to those in

224   the high HRQOL group (4.6 %). Furthermore, respondents in the high HRQOL group

225   experienced a better overall care coordination ($p = 0.011$) and were more satisfied with the

226   professional ($p = 0.039$) and organisational ($p = 0.002$) coordination activities compared to

227   those in the low HRQOL group. The respondents' characteristics in the low and high HRQOL

228   group are listed in Table 1.

229   [Insert Table 1]

230

231   **Health Related Quality of Life**

232   The proportion of respondents reporting a problem in one of the five dimensions of the EQ-5D

233   is shown in Table 2. The majority of health problems (47 %) were experienced within the

234   'pain/discomfort' dimension, where 44.1 % of the respondents had moderate problems and 2.9

235   % severe problems. The second highest problems (22.6 %) were experienced within the 'usual

236   activity' domain, where 21% indicated a moderate health problem and 1.6 % a severe health

237   problem. The least referred dimension (3.6 %) was 'self-care', with 3.5 % moderate and 0.1 %

238   severe health problems being reported. When comparing the low and high HRQOL groups,

239   85.7 % in the low HRQOL group reported moderate to severe health problems in the 'pain/

240   discomfort' dimension, 59.8 % in the 'usual activity' dimension, and 54.2 % in the 'mobility'

241   dimension (see Table 2).

242   [Insert Table 2]

Integrated service delivery and HRQOL

244 Table 3 shows the results of the bivariate and multivariate logistic regression analysis of the

245 integrated care variables with the five HRQOL dimensions and group scores. The bivariate

246 analysis demonstrated that age and unemployment were associated with statistically significant

247 increases in the odds of reporting any problem in the HRQOL dimensions. No relation occurred

248 between age and overall HRQOL group score (OR = 1.0, 95 % CI 0.99 - 1.01, p = 0.49).

249 Married people were more likely to report any problem in the dimensions of anxiety/ depression

250 (OR=2.27, 95% CI 1.58-3.26, p < 0.0001) and usual activity (OR=1.26, 95% CI 0.90-1.75, p =

251 0.18), and overall low HRQOL (OR=0.57, 95% CI 0.42-0.79, p < 0.001).

252 An improved organizational care coordination experience increased the odds of a better

253 HRQOL (OR = 1.72, 95 % CI 1.24 - 2.39, p = 0.001), and reporting no health problems in the

254 anxiety/ depression (OR = 0.43, 95 % CI 0.29 - 0.64, p < 0.0001), pain discomfort (OR = 0.71,

255 95 % CI 0.53 - 0.94, p = 0.019), and usual activities (OR = 0.58, 95% CI 0.41 - 0.82, p = 0.002)

256 dimensions. Similar findings were observed for a better professional coordination experience

257 where the odds increased for reporting a higher overall HRQOL (OR = 1.48, 95% CI 1.13 -

258 1.96, p = 0.005), and fewer health problems in the anxiety/ depression (OR = 0.64, 95% CI 0.46

259 - 0.89, p = 0.007) and pain discomfort (OR = 0.69, 95% CI 0.54 - 0.89, p = 0.003) domain.

260 Finally, people who experienced better clinical care coordination had increased odds of

261 reporting fewer problems in the usual activity dimension (OR = 0.76, 95% CI 0.59 - 0.97, p <

262 0.026).

263 The multivariate logistic regression analysis confirmed that the odds of reporting any

264 HRQOL problem were significantly higher for those unemployed (see Table 3 and Figure 2).

265 People who were married were less likely to report any problem of anxiety/ depression (OR =

266 0.47, 95% CI 0.31 - 0.72, p < 0.0001) and had a better overall HRQOL (OR = 1.60, 95% CI

267 1.13 - 2.26, p = 0.008). Aging increased the odds of reporting problems in the mobility (OR =

268   1.06, 95% CI 1.04 - 1.09, p < 0.0001), self-care (OR = 1.06, 95% CI 1.02 - 1.11, p = 0.004),

269   usual activities (OR = 1.03, 95% CI 1.01 - 1.05, p = 0.001) and pain and discomfort (OR =

270   1.02, 95% CI 1.01 - 1.04, p = 0.007) domains. Being female increased the odds of reporting

271   problems in the pain and discomfort domain (OR = 1.47, 95% CI 1.11 - 1.95, p = 0.008).

272   A better organizational coordination experience increased the odds of a higher overall HRQOL

273   (OR = 1.87, 95% CI 1.18 - 2.95, p = 0.007) and reporting fewer health problems in the anxiety/

274   depression domain (OR = 0.36, 95% CI 0.20 - 0.63, p < 0.0001). No significant relation with

275   HRQOL was found for person-centeredness, clinical coordination or professional coordination.

276   The Hosmer-Lemeshow goodness-of-fit test p-values ranged between 0.35 and 0.81, suggestive

277   of well-fitting models. The variability ranged from 6 % for the pain/discomfort model

278   (Nagelkerke R^2 = 0.06) to 16 % for the mobility, self-care, and anxiety/ depression models

279   (Nagelkerke R^2 = 0.16) (see Table 3 and Figure 2).

280   [Insert Table 3] [Insert Figure 2]

Discussion
Principle findings

283   This study showed that patients who experienced good healthcare organizational coordination

284   were more likely to report a higher overall HRQOL and fewer anxiety and depression problems.

285   No association between person-centred, clinical and professional coordination experiences and

286   HRQOL in a general primary care practice population was found. Unemployment was

287   associated with poorer overall HRQOL, and aging was associated with mobility, self-care, usual

288   activity and pain problems. Also, female patients were more likely to report pain and discomfort

289   problems. On the other hand, patients who were married reported less anxiety and depression.

Comparison with other studies

291 To our knowledge, this is the first study to evaluate the association between integrated care and

292 HRQOL in a general primary care practice population. Previous studies on integrated care and

293 HRQOL have mainly focused on patient groups with specific chronic diseases [40], older

294 populations [41] or on multimorbidity populations [42]. Furthermore, existing studies tend to

295 lack a coherent theory and solid psychometric measurement tools to compare integrated care

296 programs.

297 The results of the current study show a clear relationship between organisational

298 coordination activities and HRQOL among adult patients in a general primary care practice

299 context in the Netherlands. In contrast, earlier studies focused mainly on interventions aimed

300 at coordinating care at clinical (e.g. self-management) and professional (e.g. multidisciplinary

301 care) levels [9, 10, 41]. As such, it is possible to infer that patients in a primary care context

302 may have a potential to gain in HRQOL if GPs devise efforts to improve the inter-organisational

303 aspects of their integrated care programs. Previous research has indicated the lack of

304 organizational capacity of Dutch primary care practices [5]. No relation between clinical and

305 professional coordination and HRQOL was observed in the present study, which seems to be

306 inconsistent with previous studies [14, 17, 18, 42, 43]. This discrepancy may be due to the fact

307 that clinical and professional coordination have more influence on the perceived HRQOL of

308 people with a chronic disease whereas the entire primary care practice population was included

309 here. Therefore, information linking organisation coordination to improved HRQOL is

310 hypothesis-generating and requires confirmation in further studies. Similarly, a person-centred

311 care approach was not associated with HRQOL in this study, while aspects related to knowing

312 and addressing patients' physical, psychological and social needs are considered an essential

313 aspect of primary care service delivery [6, 20]. This could be explained by the complexity of

314 patient needs in previous studies with (multiple) chronic conditions that require more tailored

315 person-centred approaches in clinical encounters as compared to the general population, which

316 was included in this study. Therefore, further work is still required to explore the association

317 between person-centred care experiences and HRQOL in different patient groups.

318   As could be expected from previous studies [23-26], unemployment was associated with

319 a poorer HRQOL. This implicates that integrated care programs have to take into account that

320 social aspects like loneliness and financial constraints have an impact on the quality of life of

321 people in local communities. Aging was also associated with less mobility, reduced self-care,

322 usual activities and pain and discomfort problems, which is consistent with previous research

323 [21, 22]. However, no effect of aging was observed on overall HRQOL. This inconsistency

324 could be related to the sample composition whereby the entire primary practice population was

325 included while previous studies were limited to chronic disease populations. The present study

326 also corroborates that being female heightened the chance of a lower HRQOL[22, 26],

327 especially when evaluating pain and discomfort problems. The current results showed that

328 married participants had a higher overall HRQOL and reported fewer anxiety and depression

329 problems compared to singles, which is in accordance with a previous primary care study [25].

330 As such, GPs participating in integrated care programs should be aware of a possible

331 accumulation of these risk factors, notably for women living alone and who are unemployed.

332 To further understand the relationship between integrated care and HRQOL and these

333 sociodemographic determinants, more research is needed.

Strengths and limitations of this study

335 The strength of the present study is that it was grounded theoretically on the RMIC. The

336 explored association between integrated care and HRQOL was based on preliminary evidence

337 also grounded on the RMIC [5, 6, 10, 33-38]. Since thorough research into the effects of

338 integrated care at organisational levels is scarce [10], this study is provides a unique and

339 valuable contribution to the existing knowledge of integrated primary care. Potentially boosting

340 the external validity of our findings was the use of a cross-sectional design in a general primary

341   care practice population. With regard to the used measures, firstly HRQOL was measured using

342   the EQ-5D, which is a generic measure applicable in a general practice population. The EQ-5D

343   has a good construct validity and is simpler to use and briefer than other HRQOL measures

344   [44]. Secondly, the RMIC-MT patient version is considered a brief, reliable, and validated

345   measurement tool to measure integrated care in routine practice [10]. The RMIC-MT patient

346   version is also considered to be the most comprehensive patient experience measure that

347   assesses all essential aspects of integrated care [38].

348   However, this study also has several limitations. First, due to the cross-sectional nature

349   of our study, the direction of the association between integrated care and HRQOL cannot be

350   established. Moreover, it is unclear if differences in integrated care scores reflect actual

351   differences in care delivery or differences in the perception of care [9]. For this reason, a follow-

352   up study will be beneficial to explore and deepen our understanding of the associations. A

353   second limitation is caused by the unavailability of routine health data. As such, it was not

354   possible to account for other factors (e.g. number of chronic diseases) that might be associated

355   with perceptions of care delivery and quality of life. Our study was conducted among the

356   general primary care practice population, so the logical next step would be to replicate these

357   analyses by exploring in depth the sociodemographic, care integration and health data of people

358   with a low HRQOL. Accordingly, future studies should consider other outcome measures (e.g.

359   service use, satisfaction, quality of care) as well as potential effect modifiers of integrated care

360   to explore the peculiarities of their relationship with HRQOL. A third limitation of this study

361   is the use of the EQ-5D-3L. Recent studies have indicated that the EQ-5D-5L leads to more

362   accurate measurement properties due to fewer ceiling effects, especially in relation to mild

363   health problems [45]. In addition, we dichotomised the TTO score to explore differences in

364   integrated care experiences between people with a good and poor HRQOL. This might have

365   led to an overestimation, thus the current results should be considered as hypothesis-generating

366 for further longitudinal studies (e.g., realist RCTs) exploring the relationship between

367 integrated care and HRQOL. Fourth, our findings are limited by selection bias inherent to the

368 convenient sample of patients that participated in this study. The participating primary care

369 practices are restricted to a narrow geographical region in the Netherlands. Moreover, the

370 response rate of the present study is relatively low compared to other patient survey studies in

371 the Netherlands [29], which might have resulted in an underestimation or overestimation of our

372 results. Nevertheless, the results generated from this relatively small sample will be useful to

373 validate studies with a larger sample.

Implications for practice

375 The association between organisational integration and perceived quality of life found in this

376 study could be considered a first step forward to improving the inter-organisational capacity of

377 primary care practices. These findings reinforce the necessity of long-term policies and

378 incentives to enhance integrated primary care teams to meet the care needs of people in local

379 communities in the Netherlands. Further studies with a longitudinal design are needed to

380 evaluate the effect of integrated care activities within primary care services on HRQOL

381 measures. Moreover, future studies on the effectiveness of integrated care interventions must

382 consider local contextual characteristics of the studied population by uniting realist with

383 reductionist evaluation designs (e.g. realist RCTs) [9]. Often the context in which integrated

384 care interventions are implemented is overlooked. These studies are crucial as it will allow

385 policy makers to tailor the choice of interventions to the desired outcome, available resources,

386 and local healthcare context.

Conclusion

388 This is the first study to explore the association between integrated care and HRQOL from the

389 perspective of patients from a primary care practice population. The present study showed that

390   patients with a better organizational care coordination experience were more likely to have a

391   higher HRQOL. Unemployment and aging were associated with lower HRQOL, and people

392   who were married reported less anxiety and depression. Our findings underscore the importance

393   of enhancing the inter-organisational capacity of primary care practice when planning

394   interventions to improve the HRQOL of people in local communities.

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Authors Contributions

399   Author contributions were as follows. Study concept and design: PV; Acquisition, analysis, and

400   interpretation of the data: PV and MK; Drafting of the manuscript: PV; Critical revision of the

401   manuscript for important intellectual content: PV, MK, JH, RA; Statistical analysis: PV and

402   MK; Study supervision: PV and RA. All authors read and approved the final manuscript. PV

403   and MK had full access to all data in the study and take responsibility for the integrity of the

404   data and the accuracy of its analysis.

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Competing interests

409   The authors declare that they have no competing interests.

Data sharing statement

411   No additional data available.

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Figures

Figure 1: The Rainbow Model of Integrated Care (RMIC)

Figure 2: Association of integrated care and sociodemographic characteristics with health-related quality of life (HRQOL)

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536 # Tables

537 ## Table 1. Respondents' characteristics in the low and high HRQOL
538 group

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Variable	Low HRQOL group [a]	High HRQOL group [b]	Total	*P*
Sample size, n (%)	321 (41.7)	449 (58.3)	770 (100)	NS
Gender, n (%)[*]				
Male	121 (37.7)	228 (50.8)	349 (45.3)	<0.0001
Female	200 (62.3)	221 (49.2)	421 (54.7)	
Age (years), mean (SD)[±]	62.55 (15.64)	62.83 (13.43)	62.1 (14.4)	0.255
Marital status, n (%)[*]				
Married	204 (63.6)	334 (75.2)	538 (70.3)	0.001
Single	117 (36.4)	110 (24.8)	227 (29.7)	
Work status, n (%)[*]				
Employed	89 (30.3)	200 (46.4)	289 (39.9)	<0.0001
Unemployed	61 (20.7)	20 (4.6)	81 (11.2)	
Retired	144 (49)	211 (49)	355 (49)	
Integrated care, mean (SD)[±]				
Integrated care (RMIC-MT total)	3.68 (0.46)	3.77 (0.41)	3.73 (0.44)	0.011
Person-centeredness	3.23 (0.79)	3.30 (0.67)	3.27 (0.73)	0.329
Clinical coordination	4.05 (0.62)	4.11 (0.59)	4.09 (0.61)	0.201
Professional coordination	3.29 (0.57)	3.40 (0.49)	3.35 (0.54)	0.039
Organisational coordination	3.83 (0.46)	3.94 (0.44)	3.90 (0.46)	0.002
HRQOL, mean (SD)[±]				
TTO	0.70 (0.18)	0.99 (0.19)	0.86 (0.19)	<0.0001
EQ-VAS	64.29 (19.89)	85.94 (13.62)	76.91 (19.66)	<0.0001

540
541 Abbreviations: NS, not stated; HRQOL, Health related Quality of Life; RMIC-MT, Rainbow Model of Integrated Care

542 Measurement Tool; TTO, Time Trade-Off.

543 [a] TTO score < 0.86

544 [b] TTO score ≥ 0.86

545 [*] Chi-square test

546 [±] Mann-Whitney test

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549 **Table 2. Distribution of responses among the HRQOL dimensions**
550 **split for the low and high HRQOL groups**
551

Dimension	Level[#]	Low HRQOL group [a]	High HRQOL group [b]	Total	*P*
Mobility, n (%)[*]	1	147 (45.8)	427 (95.1)	735 (78.8)	<0.001
	2	171 (53.3)	22 (4.9)	195 (20.9)	
	3	3 (0.9)	0 (0.0)	3 (0.3)	
Self-care, n (%)[*]	1	289 (90)	449 (100)	899 (96.4)	<0.001
	2	31 (9.7)	0 (0.0)	33 (3.5)	
	3	1 (0.3)	0 (0.0)	1 (0.1)	
Usual activity, n (%)[*]	1	129 (40.2)	432 (96.2)	722 (77.4)	<0.001
	2	179 (55.8)	17 (3.8)	196 (21)	
	3	13 (4.0)	0 (0.0)	15 (1.6)	
Pain/discomfort, n (%)[*]	1	46 (14.3)	449 (100)	495 (53.1)	<0.001
	2	250 (77.9)	0 (0.0)	411 (44.1)	
	3	25 (7.8)	0 (0.0)	27 (2.9)	
Anxiety/depression, n (%)[*]	1	173 (2.2)	449 (100)	783 (83.9)	<0.001
	2	141 (43.9)	0 (0.0)	141 (15.1)	
	3	7 (2.2)	0 (0.0)	9 (1)	

552
553 [#] Level definitions (1 no problem, 2 some/moderate problem and 3 extreme problem).

554 [a] TTO score < 0.86

555 [b] TTO score ≥ 0.86

556 [*] Chi-square test

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Table 3. Bivariate and multivariate logistic regression analysis of integrated care and sociodemographic characteristics with HRQOL

Variable	Mobility				Self-Care				Usual activities				Pain/discomfort				Anxiety/depression				TTO groups			
	Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Gender																								
Male	1		NA	NA	1		NA	NA	1		NA	NA	1		1		1		1		1		1	
Female	0.997 (0.73-1.37)	0.983	NA	NA	1.573 (0.79-3.14)	0.198	NA	NA	0.840 (0.62-1.15)	0.272	NA	NA	0.679 (0.52-0.88)	0.004	1.469 (1.11-1.95)	0.008	0.619 (0.43-0.89)		1.227 (0.81-1.87)	0.39	1.705 (1.27-2.28)	<0.001	0.67 (0.48-0.93)	0.016
Age (years)	1.056 (1.04-1.07)	<0.001	1.062 (1.04-1.09)	<0.001	1.047 (1.02-1.08)	0.002	1.061 (1.02-1.11)	0.004	1.014 (1.00-1.03)	0.014	1.034 (1.012-1.05)	0.001	1.008 (1.00-1.02)	0.086	1.022 (1.01-1.04)	0.007	0.980 (0.97-0.99)		1.002 (0.98-1.02)	0.829	0.997 (0.99-1.01)	0.493	NA	NA
Marital status																								
Single	1		NA	NA	1		NA	NA	1		1		1		NA	NA	1		1		1		1	
Married	1.175 (0.837-1.65)	0.353	NA	NA	1.198 (0.58-2.49)	0.628	NA	NA	1.258 (0.90-1.75)	0.176	1.31 (0.90-1.90)	0.157	1.195 (0.90-1.90)	0.219	NA	NA	2.271 (1.58-3.26)		0.472 (0.31-0.72)	<0.001	0.574 (0.42-0.79)	0.001	1.598 (1.13-2.26)	0.008
Work status																								
Employed	1		1		1		1		1		1		1		1		1		1		1		1	
Unemployed	4.102 (2.30-7.33)	<0.001	4.311 (2.35-7.96)	<0.001	25.314 (5.50-116.49)	<0.001	24.849 (5.33-115.87)	<0.001	7.858 (4.67-13.22)	<0.001	8.426 (4.88-14.54)	<0.001	2.998 (1.84-4.88)	<0.001	2.834 (1.71-4.70)	<0.001	5.998 (3.56-10.10)		5.625 (3.24-9.76)	<0.001	0.146 (0.08-0.26)	<0.001	0.152 (0.08-0.28)	<0.001
Retired	4.236 (2.80-6.41)	<0.001	1.325 (0.74-2.36)	0.346	7.939 (1.83-34.45)	0.006	2.44 (0.46-12.83)	0.291	2.218 (1.51-3.25)	<0.001	1.13 (0.66-1.93)	0.656	1.355 (1.02-1.80)	0.036	0.924 (0.60-1.41)	0.716	0.936 (0.61-1.44)		0.905 (0.49-1.67)	0.750	0.652 (0.47-0.91)	0.010	0.590 (0.42-0.83)	0.002
Integrated care																								

Variable	Mobility				Self-Care				Usual activities				Pain/discomfort				Anxiety/depression				TTO groups			
	Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Person-centeredness	0.939 (0.76-1.17)	0.568	NA	NA	1.210 (0.75-1.95)	0.431	NA	NA	0.844 (0.68-1.04)	0.114	0.979 (0.73-1.31)	0.884	0.862 (0.72-1.03)	0.100	0.98 (0.78-1.24)	0.90	0.853 (0.67-1.08)	0.211	1.236 (0.89-1.72)	0.209	1.153 (0.95-1.41)	0.16	0.913 (0.70-1.20)	0.51
Clinical coordination	0.831 (0.64-1.07)	0.154	1.021 (0.72-1.45)	0.908	0.749 (0.44-1.28)	0.290	NA	NA	0.764 (0.59-0.97)	0.026	1.007 (0.71-1.43)	0.968	0.845 (0.68-1.05)	0.122	1.010 (0.76-1.34)	0.94	0.760 (0.57-1.01)	0.065	1.326 (0.88-1.97)	0.176	1.188 (0.94-1.51)	0.154	0.850 (0.61-1.19)	0.34
Professional coordination	1.004 (0.75-1.34)	0.976	NA	NA	1.242 (0.66-2.34)	0.501	NA	NA	0.772 (0.58-1.03)	0.077	0.982 (0.66-1.45)	0.927	0.694 (0.54-0.89)	0.003	0.82 (0.61-1.13)	0.225	0.637 (0.46-0.89)	0.080	0.854 (0.54-1.35)	0.498	1.484 (1.13-1.96)	0.005	1.173 (0.81-1.71)	0.40
Organisational coordination	0.722 (0.51-1.02)	0.064	0.777 (0.49-1.23)	0.278	0.703 (0.34-1.47)	0.35	NA	NA	0.58 (0.41-0.82)	0.002	0.643 (0.40-1.05)	0.076	0.710 (0.53-0.94)	0.019	0.792 (0.54-1.17)	0.243	0.430 (0.29-0.64)	<0.001	0.356 (0.20-0.63)	<0.001	1.720 (1.24-2.39)	0.001	1.869 (1.18-2.95)	0.007
Hosmer & Lemeshow R²	NA		0.49		NA		0.66		NA		0.62		NA		0.81		NA		0.76		NA		0.35	
Cox & Snell's R²	NA		0.10		NA		0.04		NA		0.09		NA		0.05		NA		0.10		NA		0.11	
Nagelkerke R²	NA		0.16		NA		0.16		NA		0.14		NA		0.06		NA		0.16		NA		0.14	

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Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	2
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Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	7
Bias	#9	Describe any efforts to address potential sources of bias	14
Study size	#10	Explain how the study size was arrived at	6
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	7
Statistical methods	#12c	Explain how missing data were addressed	7
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	7
Statistical methods	#12e	Describe any sensitivity analyses	8

Results

| Participants | #13a | Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable. | 8 |

Participants	#13b	Give reasons for non-participation at each stage	8
Participants	#13c	Consider use of a flow diagram	NA
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	9
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	NA
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	9
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10
Main results	#16b	Report category boundaries when continuous variables were categorized	NA
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	11

Discussion

Key results	#18	Summarise key results with reference to study objectives	11
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	13
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14

Other Information

Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

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A cross-sectional study evaluating the association between integrated care and health-related quality of life (HRQOL) in Dutch primary care

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A cross-sectional study evaluating the association between integrated care and health-related quality of life (HRQOL) in Dutch primary care

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19 # Abstract

20 ## Objectives

21 The aim of this study was to evaluate the association between integrated care and health-related

22 quality of life (HRQOL) in a primary care practice population.

23 ## Design

24 A cross-sectional survey study.
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26 ## Setting
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28 Primary care practice population.

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30 ## Participants
31
32 A sample (n= 5.562) of patients in two general practitioner (GP) practices in the Netherlands.

33

34 ## Primary outcome measures
35 The Rainbow Model of Integrated Care Measurement Tool (RMIC-MT) patient version and

36 EQ-5D was used to assess integrated service delivery and HRQOL. The association between

37 integrated care and HRQOL groups was analysed using multivariate logistic regression.

38

39 ## Results

40 Overall, 933 respondents with a mean age of 62 participated (20% response rate) in this study.

41 The multivariate analysis revealed that positive organisational coordination experiences were

42 linked to better HRQOL (OR = 1.87, 95% CI 1.18 - 2.95), and less anxiety and depression

43 problems (OR = 0.36, 95% CI 0.20 - 0.63). Unemployment was associated with a poor HRQOL

44 (OR = 0.15, 95% CI 0.08 - 0.28). Aging was associated with more mobility (OR = 1.06, 95%

45 CI 1.04 - 1.09), self-care (OR = 1.06, 95% CI 1.02 - 1.11), usual activity (OR = 1.03, 95% CI

46 1.01 - 1.05) and pain problems (OR = 1.02, 95% CI 1.01 - 1.04). Being married improved the

47 overall HRQOL (OR = 1.60, 95% CI 1.13 - 2.26), and decreased anxiety and depression (OR

48 = 0.47, 95% CI 0.31 - 0.72). Finally, females had a poor overall HRQOL (OR = 1.67, 95% CI

49 0.48 - 0.93) and more pain and discomfort problems (OR = 1.47, 95% CI 1.11 - 1.95).

Conclusion

51 This study shows for the first time that organizational coordination activities are positively

52 associated with HROQL of adult patients in a primary care context, adding to the evidence of

53 an association between integrated care and HRQOL. Also, unemployment, aging and being

54 female are accumulating risk factors that should be considered when designing integrated

55 primary care programs. Further research is needed to explore how various integration types

56 relate to HRQOL for people in local communities.

Key words

58 Integrated care, care coordination, triple aim, primary care, health-related quality of life, the

59 Netherlands; survey

Strengths and limitations of this study

61 • This is the first study to assess the relationship between integrated care and health-related

62   quality of life (HRQOL) in Dutch primary care.

63 • The Rainbow Model of Integrated Care Measurement Tool (RMIC-MT) and EQ-5D was

64   sent to 4,624 patients; a sample of 20% participated.

65 • Due to the cross-sectional study design, the causal relationship between integrated care and

66   HRQOL could not be established.

67

Introduction

68

69   Primary care is considered the cornerstone for integrating health and social services for people

70   in local communities [1]. It is also the first level of care where health is promoted and disease

71   prevented. In countries with a strong primary care system, such as the Netherlands, general

72   practitioners (GPs) provide person-centred continuous care to people in local communities. GPs

73   often collaborate with practice nurses, community pharmacists, medical specialists and home

74   care teams to deliver integrated care (i.e,. in care groups, community health centres, bundled

75   payments, subsidies programs). Yet, the coordination of care between these providers is

76   considered to be insufficient in the Netherlands, leading to fragmented care delivery [2]. There

77   is a growing concern about the lack of a coherent long-term policy to enhance the organization

78   of integrated primary care services that ensure all citizens quality of and access to care [3-5].

79   For this study, we used the Rainbow Model of Integrated Care (RMIC) to analyse the

80   extent of care integration. The RMIC provides a theoretical framework for describing the four

81   types of integration aimed at coordinating care at the clinical (e.g. self-management, case

82   management), professional (e.g. multidisciplinary care, continuity of care), organizational (e.g.

83   disease management, managed care programs) or system (e.g. healthcare policies and

84   regulations) levels [6]. The enablers describe the functional (e.g. IT, financial incentives) and

85   normative (e.g. cultural values) integration mechanisms necessary to integrate care at various

86   levels (see Figure 1). The RMIC provides a theoretical basis to understand the multi-layered

87   relationships of various types of integration and enables empirical approaches to assess

88   integrated care. Furthermore, the RMIC provides theoretically informed hypotheses on how

89   various integration types may or may not lead to improved health outcomes of the 'Triple Aim'

90   of patient care experience, and efficiency and costs [7]. The underlying assumption is that a

91   significant impact on clinical, quality of care, and economic outcomes requires various

92   interacting interventions targeted at the clinical, professional, organisational, and system levels

93   [8]. Based on the RMIC, we define integrated care as *a coordinated way of working across*

94   *multiple professionals, organisations, and sectors in order to improve the health, quality of*

95   *care, and economic outcomes for a targeted (sub)population.*

96   However, firm conclusions regarding the effects of integrated primary care on Triple

97   Aim outcomes cannot be made, due to the lack of rigorous long-term evaluation programs [8,

98   9]. In addition, empirical evidence on whether the impact on these outcomes might differ

99   between these integrated care levels is lacking [9, 10]. Most existing studies focus on integrated

100 primary care interventions at the clinical level, while interventions targeted at meso

101 organisational integration and macro system levels are scarce. As a result, few integrated

102 primary care models are widely implemented (e.g. patient-centred medical homes, accountable

103 care organisations, community care groups), and the current net benefit of integrated primary

104 care and how outcomes are achieved remains partly unknown [5, 11-13].

105   There is a need to determine if integrated care approaches produce better health status

106 outcomes within primary care contexts. In this context, HRQOL can be considered as an

107 indicator by which patients express their views and perceptions about their health status, which

108 measures the effect integrated primary care has on them. Several reviews have shown positive

109 effects of integrated care on HRQOL of people with chronic diseases like diabetes [14, 15],

110 heart failure [16], depression [17] and chronic obstructive pulmonary disease [18, 19]. Although

111 this knowledge is valuable, a disease-focused approach is considered dysfunctional in primary

112 care, given that general practitioners' practices consists of a wide range of patients with vastly

113 different socio-demographics and health problems [6, 20]. Specifically, the essence of primary

114 care is to provide person-focused rather than disease-focused care [6, 20]. Yet, published

115 studies describing the content and impact of integrated care models on HRQOL in a general

116 primary care patient population are lacking. Patient-level HRQOL is essential for monitoring

117 integrated primary care and designing improvement programs. In order to design effective

118   integrated primary care programmes for (sub)populations, information on the relationship

119   between integrated care, HRQOL and sociodemographic characteristics is needed. Factors like

120   aging [21, 22], unemployment [23, 24], marital status [25], gender [22, 26] and comorbidities

121   [21, 22, 25] have been found to affect HRQOL within a primary care context. Thus, these

122   sociodemographic factors should be taken into account when developing integrated care

123   programs to understand which patients are most likely to respond to different types of integrated

124   care interventions.

125   In view of the above, this study aimed to assess the relation between integrated care and

126   HRQOL of patients in primary care practices in a community setting. Based on the RMIC we

127   hypothesize that an improved overall integrated care experience is positively associated with a

128   better HRQOL. The following research objectives were posed:

129   1. To examine the association between integrated care and HRQOL in a primary care practice

130   population.

131   2. To examine the association between sociodemographic (gender, age, employment and

132   marital status) characteristics and HRQOL in a primary care practice population.

133   [Insert Figure 1]

Methods

135   The present study used a cross-sectional survey design exploring the relationship between

136   integrated care and HRQOL in 4,624 individuals registered in two primary care centres in an

137   urban region in the Netherlands, between June and July 2019.

Participants

139   Participants in this study were registered in two primary care centres in Brummen (n=1.854)

140   and Eerbeek (n=2.770). Since 2006, approximately 80% of all primary care practices in the

141   Netherlands have delivered integrated care programs for several chronic conditions (e.g.

142   diabetes, cardio-vascular risk, chronic obstructive pulmonary disease (COPD), depression, frail

143   elderly etc.) [27]. Both primary care centres included in this study delivered these integrated

144   care programs.

145   Participants were eligible to participate when they were 18 years or older. Participants

146   that were unable or unwilling to provide informed consent were excluded from the study. The

147   sample size method for an unknown population was used to calculate the sample size, which

148   was estimated to be 963 respondents (481 from each primary care center) according to a

149   standardized medium effect size of 0.3 [28], α error probability of 0.05, power (1−β error

150   probability) of 0.95 and 30 % response rate [29] using the GPower version 3.1.9.2 [30].

Procedure
151

152   Participating primary care centers received a written information package consisting of an

153   introduction letter and patient information sheet to inform care providers and patients about the

154   study's purpose and data collection methods. Participants were asked to complete digital

155   informed consent before enrolment in the study. A hyperlink to a web-based survey platform

156   was sent by email, and two reminders were sent to the participants by email. A forced answering

157   procedure (i.e. respondents had to answer each question before they were allowed to proceed

158   to the next question) was used to prevent missing answers [10]. Patient-specific codes were

159   assigned to each survey, and the response rate per primary care center was checked and reported

160   back to each center once a week during the data collection period.

Measures
161

162

163   *Sociodemographic data.* Several sociodemographic information was collected through

164   the online survey (gender, age, marital status, and work status).

165   *Health-related Quality of Life*. Health-related Quality of Life was assessed using the

166   EQ-5D-3L, which is a validated instrument consisting of five subscales (mobility, self-care,

167   usual activities, pain-discomfort, anxiety-depression) with three response levels and a visual

168   analogue scale (EQ-VAS) that evaluates health status between 0 (worst imaginable health)

169 and 100 (best imaginable health). We used the Dutch Time Trade-Off (TTO) value set [31] to

170 calculate the TTO score. The EQ-5D-3L Dutch TTO preference value ranged from -0.33 to

171 1.00 [31].

172 *Integrated care*. The Rainbow Model of Integrated Care Measurement Tool (RMIC-

173 MT) patient version measures the extent to which patients experience the integration of care

174 [10, 32]. The 16-item survey consists of four subscales representing domains of the RMIC from

175 a patient perspective: person-centeredness (2 items, e.g. needs assessment), clinical

176 coordination (6 items, e.g. personal care plan), professional coordination (4 items, e.g.

177 multidisciplinary team), and organisational coordination (4 items, e.g. inter-organisational

178 partnership). Patients rate each item on a 5-point Likert scale indicating how they experience

179 the coordination, ranging from poor (1) to very good (5). Ratings are averaged to yield subscale

180 scores and an overall summary score. The RMIC-MT is a validated questionnaire used in

181 previous primary care studies [33-38].

Statistical Analysis

182

183 Descriptive statistics were used to summarize the patients' characteristics, HRQOL, TTO, and

184 RMIC-MT scales. The mean and standard deviation were reported for continuous variables

185 such as age, utility, HRQOL, and RMIC-MT scales. Frequencies and percentages were used

186 for categorical variables. Cronbach's Alpha was calculated for the RMIC-MT subscales to asses

187 internal consistency. The Chi-square test was used to evaluate proportional difference in

188 categorial variables. The Mann-Whitney nonparametric test was used for between group

189 differences. Both bivariate and multivariate logistic regression analyses were used to assess the

190 association between the four independent continuous subscales of the RMIC-MT and the

191 dependent ordinal HRQOL variables. The dimensions of the EQ-5D-3L were dichotomised by

192 grouping severity levels 2 (some problems) and 3 (extreme problems) as poor HRQOL, and

193 assigning severity level 1 (no problem) as good HRQOL [26]. In addition, the TTO score was

194 dichotomised as good (i.e. $\geq \mu$) and poor (i.e. $< \mu$, reference category) HRQOL groups based

195 on the mean TTO score. All variables with $p \leq 0.2$ in the bivariate analysis were included in the

196 multivariate analysis because of the explorative nature of this study. Significance of the

197 variables was assessed by the p-values (< 0.05), odds ratios (OR) and 95 % confidence intervals

198 (CI) for associations between RMIC-MT subscale scores and HRQOL. The Hosmer-Lemeshow

199 goodness-of-fit statistic with p-value above 0.05 was considered a well-fitting regression

200 model, and the percentage of the variability predicted by the model is explained by the

201 Nagelkerke R^2 [39]. No adjustments for multiple testing were made given the explorative nature

202 of this study [40], and to avoid potential interpretation errors (i.e. type 2 errors) [41]. Data

203 analyses were performed using SPSS version 23.0 (IBM SPSS Statistics, 2015) and the

204 statistical software package R (http://www.R-project.org, The R Foundation).

205 Ethics

206 Participation in this study was on a voluntary basis. Participants signed a written informed

207 consent form that included providing permission to record data for research and publication

208 purposes in an anonymized manner. No further research ethics approval was needed because

209 the study was considered noninterventional according to the Dutch Medical Research and

210 Human Subjects Act (WMO).

211 Patient and public involvement

212 Patients and the public were not involved in the design of the study, or in the recruitment of the

213 study. Results were disseminated through a local focus group and the website of participating

214 GP practices.

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215 # Results

216 ## Study sample

217 A total of 933 respondents participated (20.2 % response rate) in this study. The mean age of

218 the participants was 62.1 (14.4) years, and 54.7 % of the sample were female. The majority of

219 the participants were married (70.3 %) and almost half (49 %) were retired. Of the participants,

220 449 were categorised in the high HRQOL group (58.3 %) and the remaining 321 were in the

221 low HRQOL group (41.7%). There was a statistically significant difference in gender ($p <$

222 0.0001) marital status ($p = 0.001$) and work status ($p < 0.0001$) between HRQOL groups.

223 Unemployment (20.7 %) was especially high in the low HRQOL group compared to those in

224 the high HRQOL group (4.6 %). Furthermore, respondents in the high HRQOL group

225 experienced a better overall care coordination ($p = 0.011$) and were more satisfied with the

226 professional ($p = 0.039$) and organisational ($p = 0.002$) coordination activities compared to

227 those in the low HRQOL group. The respondents' characteristics in the low and high HRQOL

228 group are listed in Table 1.

229 [Insert Table 1]

230

231 **Health Related Quality of Life**
232 The proportion of respondents reporting a problem in one of the five dimensions of the EQ-5D

233 is shown in Table 2. The majority of health problems (47 %) were experienced within the

234 'pain/discomfort' dimension, where 44.1 % of the respondents had moderate problems and 2.9

235 % severe problems. The second highest problems (22.6 %) were experienced within the 'usual

236 activity' domain, where 21% indicated a moderate health problem and 1.6 % a severe health

237 problem. The least referred dimension (3.6 %) was 'self-care', with 3.5 % moderate and 0.1 %

238 severe health problems being reported. When comparing the low and high HRQOL groups,

239 85.7 % in the low HRQOL group reported moderate to severe health problems in the 'pain/

240 discomfort' dimension, 59.8 % in the 'usual activity' dimension, and 54.2 % in the 'mobility'

241 dimension (see Table 2).

242 [Insert Table 2]

Integrated service delivery and HRQOL

244 Table 3 shows the results of the bivariate and multivariate logistic regression analysis of the

245 integrated care variables with the five HRQOL dimensions and group scores. The bivariate

246 analysis demonstrated that age and unemployment were associated with statistically significant

247 increases in the odds of reporting any problem in the HRQOL dimensions. No relation occurred

248 between age and overall HRQOL group score (OR = 1.0, 95 % CI 0.99 - 1.01, p = 0.49).

249 Married people were more likely to report any problem in the dimensions of anxiety/ depression

250 (OR=2.27, 95% CI 1.58-3.26, p < 0.0001) and usual activity (OR=1.26, 95% CI 0.90-1.75, p =

251 0.18), and overall low HRQOL (OR=0.57, 95% CI 0.42-0.79, p < 0.001).

252 An improved organizational care coordination experience increased the odds of a better

253 HRQOL (OR = 1.72, 95 % CI 1.24 - 2.39, p = 0.001), and reporting no health problems in the

254 anxiety/ depression (OR = 0.43, 95 % CI 0.29 - 0.64, p < 0.0001), pain discomfort (OR = 0.71,

255 95 % CI 0.53 - 0.94, p = 0.019), and usual activities (OR = 0.58, 95% CI 0.41 - 0.82, p = 0.002)

256 dimensions. Similar findings were observed for a better professional coordination experience

257 where the odds increased for reporting a higher overall HRQOL (OR = 1.48, 95% CI 1.13 -

258 1.96, p = 0.005), and fewer health problems in the anxiety/ depression (OR = 0.64, 95% CI 0.46

259 - 0.89, p = 0.007) and pain discomfort (OR = 0.69, 95% CI 0.54 - 0.89, p = 0.003) domain.

260 Finally, people who experienced better clinical care coordination had increased odds of

261 reporting fewer problems in the usual activity dimension (OR = 0.76, 95% CI 0.59 - 0.97, p <

262 0.026).

263   The multivariate logistic regression analysis confirmed that the odds of reporting any

264 HRQOL problem were significantly higher for those unemployed (see Table 3 and Figure 2).

265 People who were married were less likely to report any problem of anxiety/ depression (OR =

266 0.47, 95% CI 0.31 - 0.72, *p* < 0.0001) and had a better overall HRQOL (OR = 1.60, 95% CI

267 1.13 - 2.26, *p* = 0.008). Aging increased the odds of reporting problems in the mobility (OR =

268 1.06, 95% CI 1.04 - 1.09, *p* < 0.0001), self-care (OR = 1.06, 95% CI 1.02 - 1.11, *p* = 0.004),

269 usual activities (OR = 1.03, 95% CI 1.01 - 1.05, *p* = 0.001) and pain and discomfort (OR =

270 1.02, 95% CI 1.01 - 1.04, *p* = 0.007) domains. Being female increased the odds of reporting

271 problems in the pain and discomfort domain (OR = 1.47, 95% CI 1.11 - 1.95, *p* = 0.008).

272 A better organizational coordination experience increased the odds of a higher overall HRQOL

273 (OR = 1.87, 95% CI 1.18 - 2.95, *p* = 0.007) and reporting fewer health problems in the anxiety/

274 depression domain (OR = 0.36, 95% CI 0.20 - 0.63, *p* < 0.0001). No significant relation with

275 HRQOL was found for person-centeredness, clinical coordination or professional coordination.

276 The Hosmer-Lemeshow goodness-of-fit test *p*-values ranged between 0.35 and 0.81, suggestive

277 of well-fitting models. The variability ranged from 6 % for the pain/discomfort model

278 (Nagelkerke R^2 = 0.06) to 16 % for the mobility, self-care, and anxiety/ depression models

279 (Nagelkerke R^2 = 0.16) (see Table 3 and Figure 2).

280 [Insert Table 3] [Insert Figure 2]

Discussion
Principle findings

283 This study showed that patients who experienced good healthcare organizational coordination

284 were more likely to report a higher overall HRQOL and fewer anxiety and depression problems.

285 No association between person-centred, clinical and professional coordination experiences and

286 HRQOL in a general primary care practice population was found. Unemployment was

287 associated with poorer overall HRQOL, and aging was associated with mobility, self-care, usual

288 activity and pain problems. Also, female patients were more likely to report pain and discomfort

289 problems. On the other hand, patients who were married reported less anxiety and depression.

Comparison with other studies

291 To our knowledge, this is the first study to evaluate the association between integrated care and

292 HRQOL in a general primary care practice population. Previous studies on integrated care and

293 HRQOL have mainly focused on patient groups with specific chronic diseases [42], older

294 populations [43] or on multimorbidity populations [44]. Furthermore, existing studies tend to

295 lack a coherent theory and solid psychometric measurement tools to compare integrated care

296 programs.

297 The results of the current study show a relationship between organisational coordination

298 activities and HRQOL among adult patients in a general primary care practice context in the

299 Netherlands. In contrast, earlier studies focused mainly on interventions aimed at coordinating

300 care at clinical (e.g. self-management) and professional (e.g. multidisciplinary care) levels [9,

301 10, 43]. As such, it is possible to infer that patients in a primary care context may have a

302 potential to gain in HRQOL if GPs devise efforts to improve the inter-organisational aspects of

303 their integrated care programs. Previous research has indicated the lack of organizational

304 capacity of Dutch primary care practices [5]. No relation between clinical and professional

305 coordination and HRQOL was observed in the present study, which seems to be inconsistent

306 with previous studies [14, 17, 18, 44, 45]. This discrepancy may be due to the fact that clinical

307 and professional coordination have more influence on the perceived HRQOL of people with a

308 chronic disease whereas the entire primary care practice population was included here.

309 Therefore, information linking organisation coordination to improved HRQOL is hypothesis-

310 generating and requires confirmation in further studies. Similarly, a person-centred care

311 approach was not associated with HRQOL in this study, while aspects related to knowing and

312 addressing patients' physical, psychological and social needs are considered an essential aspect

313 of primary care service delivery [6, 20]. This could be explained by the complexity of patient

314 needs in previous studies with (multiple) chronic conditions that require more tailored person-

315 centred approaches in clinical encounters as compared to the general population, which was

316 included in this study. Therefore, further work is still required to explore the association

317 between person-centred care experiences and HRQOL in different patient groups.

318 As could be expected from previous studies [23-26], unemployment was associated with

319 a poorer HRQOL. This implicates that integrated care programs have to take into account that

320 social aspects like loneliness and financial constraints have an impact on the quality of life of

321 people in local communities. Aging was also associated with less mobility, reduced self-care,

322 usual activities and pain and discomfort problems, which is consistent with previous research

323 [21, 22]. However, no effect of aging was observed on overall HRQOL. This inconsistency

324 could be related to the sample composition whereby the entire primary practice population was

325 included while previous studies were limited to chronic disease populations. The present study

326 also corroborates that being female heightened the chance of a lower HRQOL[22, 26],

327 especially when evaluating pain and discomfort problems. The current results showed that

328 married participants had a higher overall HRQOL and reported fewer anxiety and depression

329 problems compared to singles, which is in accordance with a previous primary care study [25].

330 As such, GPs participating in integrated care programs should be aware of a possible

331 accumulation of these risk factors, notably for women living alone and who are unemployed.

332 To further understand the relationship between integrated care and HRQOL and these

333 sociodemographic determinants, more research is needed.

Strengths and limitations of this study

335 The strength of the present study is that it was grounded theoretically on the RMIC. The

336 explored association between integrated care and HRQOL was based on preliminary evidence

337 also grounded on the RMIC [5, 6, 10, 33-38]. Since thorough research into the effects of

338 integrated care at organisational levels is scarce [10], this study provides a unique and valuable

339 contribution to the existing knowledge of integrated primary care. Potentially boosting the

340 external validity of our findings was the use of a cross-sectional design in a general primary

341 care practice population. With regard to the used measures, firstly HRQOL was measured using

342 the EQ-5D, which is a generic measure applicable in a general practice population. The EQ-5D

343 has a good construct validity and is simpler to use and briefer than other HRQOL measures

344 [46]. Secondly, the RMIC-MT patient version is considered a brief, reliable, and validated

345 measurement tool to measure integrated care in routine practice [10]. The RMIC-MT patient

346 version is also considered to be the most comprehensive patient experience measure that

347 assesses all essential aspects of integrated care [38].

348 However, this study also has several limitations. First, due to the cross-sectional nature

349 of our study, the direction of the association between integrated care and HRQOL cannot be

350 established. It is unclear if differences in integrated care scores reflect actual differences in care

351 delivery or differences in the perception of care [9]. Moreover, the relatively small effect sizes

352 found in this study also suggest that the larger study samples are needed to further explore the

353 association between integrated care and HRQOL. A follow-up study with a more controlled

354 design (e.g. realist RCT's) with a larger sample will be beneficial to further explore and deepen

355 our understanding of the associations between integrated care and HRQOL. In future studies,

356 it would also be recommendable to independently assess the degree of integrated care from

357 various stakeholder perspectives (e.g. patient, care provider, manager, policymaker). In

358 addition to increasing external validity, the risk of confounders can be reduced by assessing

359 multiple perspectives. A second limitation is caused by the unavailability of routine health data.

360 As such, it was not possible to account for other factors (e.g. number of chronic diseases) that

361 might be associated with perceptions of care delivery and quality of life. Our study was

362 conducted among the general primary care practice population, so the logical next step would

363 be to replicate these analyses by exploring in depth the sociodemographic, care integration and

364 health data of people with a low HRQOL. Accordingly, future studies should consider other

365 outcome measures (e.g. service use, satisfaction, quality of care) as well as potential effect

366 modifiers of integrated care to explore the peculiarities of their relationship with HRQOL. A

367 third limitation of this study is the use of the EQ-5D-3L. Recent studies have indicated that the

368 EQ-5D-5L leads to more accurate measurement properties due to fewer ceiling effects,

369 especially in relation to mild health problems [47]. In addition, we dichotomised the TTO score

370 to explore differences in integrated care experiences between people with a good and poor

371 HRQOL. This might have led to an under- or overestimation, thus the current results should be

372 considered as hypothesis-generating for further longitudinal studies (e.g., realist RCTs)

373 exploring the relationship between integrated care and HRQOL. Fourth, our findings are limited

374 by selection bias inherent to the convenient sample of patients that participated in this study.

375 The participating primary care practices are restricted to a narrow geographical region in the

376 Netherlands. Moreover, the response rate of the present study is relatively low compared to

377 other patient survey studies in the Netherlands [29], which might have resulted in an

378 underestimation or overestimation of our results. Nevertheless, the results generated from this

379 relatively small sample will be useful to validate studies with a larger sample.

380 Implications for practice

381 The association between organisational integration and perceived quality of life found in this

382 study could be considered a first step forward to improving the inter-organisational capacity of

383 primary care practices. These findings reinforce the necessity of long-term policies and

384 incentives to enhance integrated primary care teams to meet the care needs of people in local

385 communities in the Netherlands. Further studies with a longitudinal design are needed to

386 evaluate the effect of integrated care activities within primary care services on HRQOL

387 measures. Moreover, future studies on the effectiveness of integrated care interventions must

388 consider local contextual characteristics of the studied population by uniting realist with

389 reductionist evaluation designs (e.g. realist RCTs) [9]. Often the context in which integrated

390 care interventions are implemented is overlooked. These studies are crucial as it will allow

391 policy makers to tailor the choice of interventions to the desired outcome, available resources,

392 and local healthcare context.

Conclusion

394 This is the first study to explore the association between integrated care and HRQOL from the

395 perspective of patients from a primary care practice population. The present study showed that

396 patients with a better organizational care coordination experience were more likely to have a

397 higher HRQOL. Unemployment and aging were associated with lower HRQOL, and people

398 who were married reported less anxiety and depression. Our findings underscore the importance

399 of enhancing the inter-organisational capacity of primary care practice when planning

400 interventions to improve the HRQOL of people in local communities.

Acknowledgements

Authors Contributions

405 Author contributions were as follows. Study concept and design: PV; Acquisition, analysis, and

406 interpretation of the data: PV and MK; Drafting of the manuscript: PV; Critical revision of the

407 manuscript for important intellectual content: PV, MK, JH, RA; Statistical analysis: PV and

408 MK; Study supervision: PV and RA. All authors read and approved the final manuscript. PV

409 and MK had full access to all data in the study and take responsibility for the integrity of the

410 data and the accuracy of its analysis.

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Competing interests

415 The authors declare that they have no competing interests.

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416 **Data sharing statement**

417 No additional data available.

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538 **Figures**

539 **Figure 1: The Rainbow Model of Integrated Care (RMIC)**

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541 **Figure 2: Association of integrated care and sociodemographic**
542 **characteristics with health-related quality of life (HRQOL)**

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Tables

Table 1. Respondents' characteristics in the low and high HRQOL group

Variable	Low HRQOL group [a]	High HRQOL group [b]	Total	*P*
Sample size, n (%)	321 (41.7)	449 (58.3)	770 (100)	NS
Gender, n (%)[*]				
Male	121 (37.7)	228 (50.8)	349 (45.3)	<0.0001
Female	200 (62.3)	221 (49.2)	421 (54.7)	
Age (years), mean (SD)[±]	62.55 (15.64)	62.83 (13.43)	62.1 (14.4)	0.255
Marital status, n (%)[*]				
Married	204 (63.6)	334 (75.2)	538 (70.3)	0.001
Single	117 (36.4)	110 (24.8)	227 (29.7)	
Work status, n (%)[*]				
Employed	89 (30.3)	200 (46.4)	289 (39.9)	<0.0001
Unemployed	61 (20.7)	20 (4.6)	81 (11.2)	
Retired	144 (49)	211 (49)	355 (49)	
Integrated care, mean (SD)[±]				
Integrated care (RMIC-MT total)	3.68 (0.46)	3.77 (0.41)	3.73 (0.44)	0.011
Person-centeredness	3.23 (0.79)	3.30 (0.67)	3.27 (0.73)	0.329
Clinical coordination	4.05 (0.62)	4.11 (0.59)	4.09 (0.61)	0.201
Professional coordination	3.29 (0.57)	3.40 (0.49)	3.35 (0.54)	0.039
Organisational coordination	3.83 (0.46)	3.94 (0.44)	3.90 (0.46)	0.002
HRQOL, mean (SD)[±]				
TTO	0.70 (0.18)	0.99 (0.19)	0.86 (0.19)	<0.0001
EQ-VAS	64.29 (19.89)	85.94 (13.62)	76.91 (19.66)	<0.0001

Abbreviations: NS, not stated; HRQOL, Health related Quality of Life; RMIC-MT, Rainbow Model of Integrated Care

Measurement Tool; TTO, Time Trade-Off.

[a] TTO score < 0.86

[b] TTO score ≥ 0.86

[*] Chi-square test

[±] Mann-Whitney test

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559 **Table 2. Distribution of responses among the HRQOL dimensions**
560 **split for the low and high HRQOL groups**

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Dimension	Level[#]	Low HRQOL group [a]	High HRQOL group [b]	Total	*P*
Mobility, n (%)[*]	1	147 (45.8)	427 (95.1)	735 (78.8)	<0.001
	2	171 (53.3)	22 (4.9)	195 (20.9)	
	3	3 (0.9)	0 (0.0)	3 (0.3)	
Self-care, n (%)[*]	1	289 (90)	449 (100)	899 (96.4)	<0.001
	2	31 (9.7)	0 (0.0)	33 (3.5)	
	3	1 (0.3)	0 (0.0)	1 (0.1)	
Usual activity, n (%)[*]	1	129 (40.2)	432 (96.2)	722 (77.4)	<0.001
	2	179 (55.8)	17 (3.8)	196 (21)	
	3	13 (4.0)	0 (0.0)	15 (1.6)	
Pain/discomfort, n (%)[*]	1	46 (14.3)	449 (100)	495 (53.1)	<0.001
	2	250 (77.9)	0 (0.0)	411 (44.1)	
	3	25 (7.8)	0 (0.0)	27 (2.9)	
Anxiety/depression, n (%)[*]	1	173 (2.2)	449 (100)	783 (83.9)	<0.001
	2	141 (43.9)	0 (0.0)	141 (15.1)	
	3	7 (2.2)	0 (0.0)	9 (1)	

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563 [#] Level definitions (1 no problem, 2 some/moderate problem and 3 extreme problem).

564 [a] TTO score < 0.86

565 [b] TTO score ≥ 0.86

566 [*] Chi-square test

567

Table 3. Bivariate and multivariate logistic regression analysis of integrated care and sociodemographic characteristics with HRQOL

Variable	Mobility Univariate OR (95% CI)	P	Mobility Multivariate OR (95% CI)	P	Self-Care Univariate OR (95% CI)	P	Self-Care Multivariate OR (95% CI)	P	Usual activities Univariate OR (95% CI)	P	Usual activities Multivariate OR (95% CI)	P	Pain/discomfort Univariate OR (95% CI)	P	Pain/discomfort Multivariate OR (95% CI)	P	Anxiety/depression Univariate OR (95% CI)	P	Anxiety/depression Multivariate OR (95% CI)	P	TTO groups Univariate OR (95% CI)	P	TTO groups Multivariate OR (95% CI)	P
Gender																								
Male	1		NA	NA	1		NA	NA	1		NA	NA	1		1		1		1		1		1	
Female	0.997 (0.73-1.37)	0.983	NA	NA	1.573 (0.79-3.14)	0.198	NA	NA	0.840 (0.62-1.15)	0.272	NA	NA	0.679 (0.52-0.88)	0.004	1.469 (1.11-1.95)	0.008	0.619 (0.43-0.89)		1.227 (0.81-1.87)	0.339	1.705 (1.27-2.28)	<0.001	0.67 (0.48-0.93)	0.016
Age (years)	1.056 (1.04-1.07)	<0.001	1.062 (1.04-1.09)	<0.001	1.047 (1.02-1.08)	0.002	1.061 (1.02-1.11)	0.004	1.014 (1.00-1.03)	0.014	1.034 (1.012-1.05)	0.001	1.008 (1.00-1.02)	0.086	1.022 (1.01-1.04)	0.007	0.980 (0.97-0.99)		1.002 (0.98-1.02)	0.829	0.997 (0.99-1.01)	0.493	NA	NA
Marital status																								
Single	1		NA	NA	1		NA	NA	1		1		1		NA	NA	1		1		1		1	
Married	1.175 (0.837-1.65)	0.353	NA	NA	1.198 (0.58-2.49)	0.628	NA	NA	1.258 (0.90-1.75)	0.176	1.31 (0.90-1.90)	0.157	1.195 (0.90-1.90)	0.219	NA	NA	2.271 (1.58-3.26)		0.472 (0.31-0.72)	<0.001	0.574 (0.42-0.79)	0.001	1.598 (1.13-2.26)	0.008
Work status																								
Employed	1		1		1		1		1		1		1		1		1		1		1		1	
Unemployed	4.102 (2.30-7.33)	<0.001	4.311 (2.35-7.96)	<0.001	25.314 (5.50-116.49)	<0.001	24.849 (5.33-115.87)	<0.001	7.858 (4.67-13.22)	<0.001	8.426 (4.88-14.54)	<0.001	2.998 (1.84-4.88)	<0.001	2.834 (1.71-4.70)	<0.001	5.998 (3.56-10.10)	<0.001	5.625 (3.24-9.76)	<0.001	0.146 (0.08-0.26)	<0.001	0.152 (0.08-0.28)	<0.001
Retired	4.236 (2.80-6.41)	<0.001	1.325 (0.74-2.36)	0.346	7.939 (1.83-34.45)	0.006	2.44 (0.46-12.83)	0.291	2.218 (1.51-3.25)	<0.001	1.13 (0.66-1.93)	0.656	1.355 (1.02-1.80)	0.036	0.924 (0.60-1.41)	0.716	0.936 (0.61-1.44)		0.905 (0.49-1.67)	0.750	0.652 (0.47-0.91)	0.010	0.590 (0.42-0.83)	0.002
Integrated care																								

Variable	Mobility				Self-Care				Usual activities				Pain/discomfort				Anxiety/depression				TTO groups			
	Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Person-centeredness	0.939 (0.76-1.17)	0.568	NA	NA	1.210 (0.75-1.95)	0.431	NA	NA	0.844 (0.68-1.04)	0.114	0.979 (0.73-1.31)	0.884	0.862 (0.72-1.03)	0.100	0.98 (0.78-1.24)	0.90	0.853 (0.67-1.08)	0.111	1.236 (0.89-1.72)	0.209	1.153 (0.95-1.41)	0.16	0.913 (0.70-1.20)	0.51
Clinical coordination	0.831 (0.64-1.07)	0.154	1.021 (0.72-1.45)	0.908	0.749 (0.44-1.28)	0.290	NA	NA	0.764 (0.59-0.97)	0.026	1.007 (0.71-1.43)	0.968	0.845 (0.68-1.05)	0.122	1.010 (0.76-1.34)	0.94	0.760 (0.57-1.01)	0.065	1.326 (0.88-1.97)	0.176	1.188 (0.94-1.51)	0.154	0.850 (0.61-1.19)	0.34
Professional coordination	1.004 (0.75-1.34)	0.976	NA	NA	1.242 (0.66-2.34)	0.501	NA	NA	0.772 (0.58-1.03)	0.077	0.982 (0.66-1.45)	0.927	0.694 (0.54-0.89)	0.003	0.82 (0.61-1.13)	0.225	0.637 (0.46-0.89)	0.008	0.854 (0.54-1.35)	0.498	1.484 (1.13-1.96)	0.005	1.173 (0.81-1.71)	0.40
Organisational coordination	0.722 (0.51-1.02)	0.064	0.777 (0.49-1.23)	0.278	0.703 (0.34-1.47)	0.35	NA	NA	0.58 (0.41-0.82)	0.002	0.643 (0.40-1.05)	0.076	0.710 (0.53-0.94)	0.019	0.792 (0.54-1.17)	0.243	0.430 (0.29-0.64)	<0.001	0.356 (0.20-0.63)	<0.001	1.720 (1.24-2.39)	0.001	1.869 (1.18-2.95)	0.007
Hosmer & Lemeshow R^2	NA		0.49		NA		0.66		NA		0.62		NA		0.81		NA		0.76		NA		0.35	
Cox & Snell's R^2	NA		0.10		NA		0.04		NA		0.09		NA		0.05		NA		0.10		NA		0.11	
Nagelkerke R^2	NA		0.16		NA		0.16		NA		0.14		NA		0.06		NA		0.16		NA		0.14	

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Mobility | Self-Care | Usual activities | Pain/discomfort | Anxiety/depression | TTO groups

Gender
Female
Male

Age years
Age years

Marital status
Married
Single

Work status
Retired
Unemployed
Employed

Integrated care
Organisational coordination
Professional coordination
Clinical coordination
Person-centeredness

Odds ratio

p-value
0.075
0.050
0.025
0.000

Reporting checklist for cross sectional study.

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Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	#4	Present key elements of study design early in the paper	6

Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6	
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	6	
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7	
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	7	
Bias	#9	Describe any efforts to address potential sources of bias	14	
Study size	#10	Explain how the study size was arrived at	6	
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7	
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7	
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	7	
Statistical methods	#12c	Explain how missing data were addressed	7	
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	7	
Statistical methods	#12e	Describe any sensitivity analyses	8	

Results

Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	8	

Participants	#13b	Give reasons for non-participation at each stage	8
Participants	#13c	Consider use of a flow diagram	NA
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	9
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	NA
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	9
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10
Main results	#16b	Report category boundaries when continuous variables were categorized	NA
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	11

Discussion

Key results	#18	Summarise key results with reference to study objectives	11
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	13
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14

Other Information				
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based		15

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A cross-sectional study evaluating the association between integrated care and health-related quality of life (HRQOL) in Dutch primary care

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19 **Abstract**

20 **Objectives**

21 The aim of this study was to evaluate the association between integrated care and health-related

22 quality of life (HRQOL) in a primary care practice population.

23 **Design**

24 A cross-sectional survey study.
25

26 **Setting**
27
28 Primary care practice population.

29

30 **Participants**
31
32 A sample (n= 5.562) of patients in two general practitioner (GP) practices in the Netherlands.

33

34 **Primary outcome measures**
35 The Rainbow Model of Integrated Care Measurement Tool (RMIC-MT) patient version and

36 EQ-5D was used to assess integrated service delivery and HRQOL. The association between

37 integrated care and HRQOL groups was analysed using multivariate logistic regression.

38

39 **Results**

40 Overall, 933 respondents with a mean age of 62 participated (20% response rate) in this study.

41 The multivariate analysis revealed that positive organisational coordination experiences were

42 linked to better HRQOL (OR = 1.87, 95% CI 1.18 - 2.95), and less anxiety and depression

43 problems (OR = 0.36, 95% CI 0.20 - 0.63). Unemployment was associated with a poor HRQOL

44 (OR = 0.15, 95% CI 0.08 - 0.28). Aging was associated with more mobility (OR = 1.06, 95%

45 CI 1.04 - 1.09), self-care (OR = 1.06, 95% CI 1.02 - 1.11), usual activity (OR = 1.03, 95% CI

46 1.01 - 1.05) and pain problems (OR = 1.02, 95% CI 1.01 - 1.04). Being married improved the

47 overall HRQOL (OR = 1.60, 95% CI 1.13 - 2.26), and decreased anxiety and depression (OR

48 = 0.47, 95% CI 0.31 - 0.72). Finally, females had a poor overall HRQOL (OR = 1.67, 95% CI

49 0.48 - 0.93) and more pain and discomfort problems (OR = 1.47, 95% CI 1.11 - 1.95).

Conclusion

51 This study shows for the first time that organizational coordination activities are positively

52 associated with HROQL of adult patients in a primary care context, adding to the evidence of

53 an association between integrated care and HRQOL. Also, unemployment, aging and being

54 female are accumulating risk factors that should be considered when designing integrated

55 primary care programs. Further research is needed to explore how various integration types

56 relate to HRQOL for people in local communities.

Key words

58 Integrated care, care coordination, triple aim, primary care, health-related quality of life, the

59 Netherlands; survey

Strengths and limitations of this study

61 • This is the first study to assess the relationship between integrated care and health-related

62 quality of life (HRQOL) in Dutch primary care.

63 • The Rainbow Model of Integrated Care Measurement Tool (RMIC-MT) and EQ-5D was

64 sent to 4,624 patients; a sample of 20% participated.

65 • Due to the cross-sectional study design, the causal relationship between integrated care and

66 HRQOL could not be established.

67

Introduction

Primary care is considered the cornerstone for integrating health and social services for people in local communities [1]. It is also the first level of care where health is promoted and disease prevented. In countries with a strong primary care system, such as the Netherlands, general practitioners (GPs) provide person-centred continuous care to people in local communities. GPs often collaborate with practice nurses, community pharmacists, medical specialists and home care teams to deliver integrated care (i.e,. in care groups, community health centres, bundled payments, subsidies programs). Yet, the coordination of care between these providers is considered to be insufficient in the Netherlands, leading to fragmented care delivery [2]. There is a growing concern about the lack of a coherent long-term policy to enhance the organization of integrated primary care services that ensure all citizens quality of and access to care [3-5].

For this study, we used the Rainbow Model of Integrated Care (RMIC) to analyse the extent of care integration [6]. The RMIC provides a theoretical framework for describing the four types of integration aimed at coordinating care at the clinical (e.g. self-management, case management), professional (e.g. multidisciplinary care, continuity of care), organizational (e.g. disease management, managed care programs) or system (e.g. healthcare policies and regulations) levels [7]. The enablers describe the functional (e.g. IT, financial incentives) and normative (e.g. cultural values) integration mechanisms necessary to integrate care at various levels. The RMIC provides a theoretical basis to understand the multi-layered relationships of various types of integration and enables empirical approaches to assess integrated care. Furthermore, the RMIC provides theoretically informed hypotheses on how various integration types may or may not lead to improved health outcomes of the 'Triple Aim' of patient care experience, and efficiency and costs [6, 8]. The underlying assumption is that a significant impact on clinical, quality of care, and economic outcomes requires various interacting interventions targeted at the clinical, professional, organisational, and system levels [9]. Based

93   on the RMIC, we define integrated care as *a coordinated way of working across multiple*

94   *professionals, organisations, and sectors in order to improve the health, quality of care, and*

95   *economic outcomes for a targeted (sub)population.*

96   However, firm conclusions regarding the effects of integrated primary care on Triple

97   Aim outcomes cannot be made, due to the lack of rigorous long-term evaluation programs [9,

98   10]. In addition, empirical evidence on whether the impact on these outcomes might differ

99   between these integrated care levels is lacking [10, 11]. Most existing studies focus on

100   integrated primary care interventions at the clinical level, while interventions targeted at meso

101   organisational integration and macro system levels are scarce. As a result, few integrated

102   primary care models are widely implemented (e.g. patient-centred medical homes, accountable

103   care organisations, community care groups), and the current net benefit of integrated primary

104   care and how outcomes are achieved remains partly unknown [5, 12-14].

105   There is a need to determine if integrated care approaches produce better health status

106   outcomes within primary care contexts. In this context, HRQOL can be considered as an

107   indicator by which patients express their views and perceptions about their health status, which

108   measures the effect integrated primary care has on them. Several reviews have shown positive

109   effects of integrated care on HRQOL of people with chronic diseases like diabetes [15, 16],

110   heart failure [17], depression [18] and chronic obstructive pulmonary disease [19, 20]. Although

111   this knowledge is valuable, a disease-focused approach is considered dysfunctional in primary

112   care, given that general practitioners' practices consists of a wide range of patients with vastly

113   different socio-demographics and health problems [7, 21]. Specifically, the essence of primary

114   care is to provide person-focused rather than disease-focused care [7, 21]. Yet, published

115   studies describing the content and impact of integrated care models on HRQOL in a general

116   primary care patient population are lacking. Patient-level HRQOL is essential for monitoring

117   integrated primary care and designing improvement programs. In order to design effective

118 integrated primary care programmes for (sub)populations, information on the relationship

119 between integrated care, HRQOL and sociodemographic characteristics is needed. Factors like

120 aging [22, 23], unemployment [24, 25], marital status [26], gender [23, 27] and comorbidities

121 [22, 23, 26] have been found to affect HRQOL within a primary care context. Thus, these

122 sociodemographic factors should be taken into account when developing integrated care

123 programs to understand which patients are most likely to respond to different types of integrated

124 care interventions.

125   In view of the above, this study aimed to assess the relation between integrated care and

126 HRQOL of patients in primary care practices in a community setting. Based on the RMIC we

127 hypothesize that an improved overall integrated care experience is positively associated with a

128 better HRQOL. The following research objectives were posed:

129 1. To examine the association between integrated care and HRQOL in a primary care practice

130   population.

131 2. To examine the association between sociodemographic (gender, age, employment and

132   marital status) characteristics and HRQOL in a primary care practice population.

Methods

134 The present study used a cross-sectional survey design exploring the relationship between

135 integrated care and HRQOL in 4,624 individuals registered in two primary care centres in an

136 urban region in the Netherlands, between June and July 2019.

Participants

138 Participants in this study were registered in two primary care centres in Brummen (n=1.854)

139 and Eerbeek (n=2.770). Since 2006, approximately 80% of all primary care practices in the

140 Netherlands have delivered integrated care programs for several chronic conditions (e.g.

141 diabetes, cardio-vascular risk, chronic obstructive pulmonary disease (COPD), depression, frail

142 elderly etc.) [28]. Both primary care centres included in this study delivered these integrated

143 care programs.

144   Participants were eligible to participate when they were 18 years or older. Participants

145 that were unable or unwilling to provide informed consent were excluded from the study. The

146 sample size method for an unknown population was used to calculate the sample size, which

147 was estimated to be 963 respondents (481 from each primary care center) according to a

148 standardized medium effect size of 0.3 [29], α error probability of 0.05, power (1–β error

149 probability) of 0.95 and 30 % response rate [30] using the GPower version 3.1.9.2 [31].

Procedure

151 Participating primary care centers received a written information package consisting of an

152 introduction letter and patient information sheet to inform care providers and patients about the

153 study's purpose and data collection methods. Participants were asked to complete digital

154 informed consent before enrolment in the study. A hyperlink to a web-based survey platform

155 was sent by email, and two reminders were sent to the participants by email. A forced answering

156 procedure (i.e. respondents had to answer each question before they were allowed to proceed

157 to the next question) was used to prevent missing answers [11]. Patient-specific codes were

158 assigned to each survey, and the response rate per primary care center was checked and reported

159 back to each center once a week during the data collection period.

Measures

161

162   *Sociodemographic data.* Several sociodemographic information was collected through

163 the online survey (gender, age, marital status, and work status).

164   *Health-related Quality of Life*. Health-related Quality of Life was assessed using the

165 EQ-5D-3L, which is a validated instrument consisting of five subscales (mobility, self-care,

166 usual activities, pain-discomfort, anxiety-depression) with three response levels and a visual

167 analogue scale (EQ-VAS) that evaluates health status between 0 (worst imaginable health)

168   and 100 (best imaginable health). We used the Dutch Time Trade-Off (TTO) value set [32] to

169   calculate the TTO score. The EQ-5D-3L Dutch TTO preference value ranged from -0.33 to

170   1.00 [32].

171   *Integrated care*. The Rainbow Model of Integrated Care Measurement Tool (RMIC-

172   MT) patient version measures the extent to which patients experience the integration of care

173   [11, 33]. The 16-item survey consists of four subscales representing domains of the RMIC from

174   a patient perspective: person-centeredness (2 items, e.g. needs assessment), clinical

175   coordination (6 items, e.g. personal care plan), professional coordination (4 items, e.g.

176   multidisciplinary team), and organisational coordination (4 items, e.g. inter-organisational

177   partnership). Patients rate each item on a 5-point Likert scale indicating how they experience

178   the coordination, ranging from poor (1) to very good (5). Ratings are averaged to yield subscale

179   scores and an overall summary score. The RMIC-MT is a validated questionnaire used in

180   previous primary care studies [34-39].

Statistical Analysis

181
182   Descriptive statistics were used to summarize the patients' characteristics, HRQOL, TTO, and

183   RMIC-MT scales. The mean and standard deviation were reported for continuous variables

184   such as age, utility, HRQOL, and RMIC-MT scales. Frequencies and percentages were used

185   for categorical variables. Cronbach's Alpha was calculated for the RMIC-MT subscales to asses

186   internal consistency. The Chi-square test was used to evaluate proportional difference in

187   categorial variables. The Mann-Whitney nonparametric test was used for between group

188   differences. Both bivariate and multivariate logistic regression analyses were used to assess the

189   association between the four independent continuous subscales of the RMIC-MT and the

190   dependent ordinal HRQOL variables. The dimensions of the EQ-5D-3L were dichotomised by

191   grouping severity levels 2 (some problems) and 3 (extreme problems) as poor HRQOL, and

192   assigning severity level 1 (no problem) as good HRQOL [27]. In addition, the TTO score was

193   dichotomised as good (i.e. $\geq \mu$) and poor (i.e. $< \mu$, reference category) HRQOL groups based

194 on the mean TTO score. All variables with $p \leq 0.2$ in the bivariate analysis were included in the

195 multivariate analysis because of the explorative nature of this study. Significance of the

196 variables was assessed by the p-values (< 0.05), odds ratios (OR) and 95 % confidence intervals

197 (CI) for associations between RMIC-MT subscale scores and HRQOL. The Hosmer-Lemeshow

198 goodness-of-fit statistic with p-value above 0.05 was considered a well-fitting regression

199 model, and the percentage of the variability predicted by the model is explained by the

200 Nagelkerke R^2 [40]. No adjustments for multiple testing were made given the explorative nature

201 of this study [41], and to avoid potential interpretation errors (i.e. type 2 errors) [42]. Data

202 analyses were performed using SPSS version 23.0 (IBM SPSS Statistics, 2015) and the

203 statistical software package R (http://www.R-project.org, The R Foundation).

204 **Ethics**

205 Participation in this study was on a voluntary basis. Participants signed a written informed

206 consent form that included providing permission to record data for research and publication

207 purposes in an anonymized manner. No further research ethics approval was needed because

208 the study was considered noninterventional according to the Dutch Medical Research and

209 Human Subjects Act (WMO).

210 **Patient and public involvement**

211 Patients and the public were not involved in the design of the study, or in the recruitment of the

212 study. Results were disseminated through a local focus group and the website of participating

213 GP practices.

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214 # Results

215 ## Study sample

216 A total of 933 respondents participated (20.2 % response rate) in this study. The mean age of

217 the participants was 62.1 (14.4) years, and 54.7 % of the sample were female. The majority of

218 the participants were married (70.3 %) and almost half (49 %) were retired. Of the participants,

219 449 were categorised in the high HRQOL group (58.3 %) and the remaining 321 were in the

220 low HRQOL group (41.7%). There was a statistically significant difference in gender ($p <$

221 0.0001) marital status ($p = 0.001$) and work status ($p < 0.0001$) between HRQOL groups.

222 Unemployment (20.7 %) was especially high in the low HRQOL group compared to those in

223 the high HRQOL group (4.6 %). Furthermore, respondents in the high HRQOL group

224 experienced a better overall care coordination ($p = 0.011$) and were more satisfied with the

225 professional ($p = 0.039$) and organisational ($p = 0.002$) coordination activities compared to

226 those in the low HRQOL group. The respondents' characteristics in the low and high HRQOL

227 group are listed in Table 1.

228 [Insert Table 1]

229

230 **Health Related Quality of Life**
231 The proportion of respondents reporting a problem in one of the five dimensions of the EQ-5D

232 is shown in Table 2. The majority of health problems (47 %) were experienced within the

233 'pain/discomfort' dimension, where 44.1 % of the respondents had moderate problems and 2.9

234 % severe problems. The second highest problems (22.6 %) were experienced within the 'usual

235 activity' domain, where 21% indicated a moderate health problem and 1.6 % a severe health

236 problem. The least referred dimension (3.6 %) was 'self-care', with 3.5 % moderate and 0.1 %

237 severe health problems being reported. When comparing the low and high HRQOL groups,

238 85.7 % in the low HRQOL group reported moderate to severe health problems in the 'pain/

239 discomfort' dimension, 59.8 % in the 'usual activity' dimension, and 54.2 % in the 'mobility'

240 dimension (see Table 2).

241 [Insert Table 2]

Integrated service delivery and HRQOL

243 Table 3 shows the results of the bivariate and multivariate logistic regression analysis of the

244 integrated care variables with the five HRQOL dimensions and group scores. The bivariate

245 analysis demonstrated that age and unemployment were associated with statistically significant

246 increases in the odds of reporting any problem in the HRQOL dimensions. No relation occurred

247 between age and overall HRQOL group score (OR = 1.0, 95 % CI 0.99 - 1.01, p = 0.49).

248 Married people were more likely to report any problem in the dimensions of anxiety/ depression

249 (OR=2.27, 95% CI 1.58-3.26, p < 0.0001) and usual activity (OR=1.26, 95% CI 0.90-1.75, p =

250 0.18), and overall low HRQOL (OR=0.57, 95% CI 0.42-0.79, p < 0.001).

251 An improved organizational care coordination experience increased the odds of a better

252 HRQOL (OR = 1.72, 95 % CI 1.24 - 2.39, p = 0.001), and reporting no health problems in the

253 anxiety/ depression (OR = 0.43, 95 % CI 0.29 - 0.64, p < 0.0001), pain discomfort (OR = 0.71,

254 95 % CI 0.53 - 0.94, p = 0.019), and usual activities (OR = 0.58, 95% CI 0.41 - 0.82, p = 0.002)

255 dimensions. Similar findings were observed for a better professional coordination experience

256 where the odds increased for reporting a higher overall HRQOL (OR = 1.48, 95% CI 1.13 -

257 1.96, p = 0.005), and fewer health problems in the anxiety/ depression (OR = 0.64, 95% CI 0.46

258 - 0.89, p = 0.007) and pain discomfort (OR = 0.69, 95% CI 0.54 - 0.89, p = 0.003) domain.

259 Finally, people who experienced better clinical care coordination had increased odds of

260 reporting fewer problems in the usual activity dimension (OR = 0.76, 95% CI 0.59 - 0.97, p <

261 0.026).

262 The multivariate logistic regression analysis confirmed that the odds of reporting any

263 HRQOL problem were significantly higher for those unemployed (see Table 3 and Figure 1).

264 People who were married were less likely to report any problem of anxiety/ depression (OR =

265 0.47, 95% CI 0.31 - 0.72, $p < 0.0001$) and had a better overall HRQOL (OR = 1.60, 95% CI

266 1.13 - 2.26, $p = 0.008$). Aging increased the odds of reporting problems in the mobility (OR =

267 1.06, 95% CI 1.04 - 1.09, $p < 0.0001$), self-care (OR = 1.06, 95% CI 1.02 - 1.11, $p = 0.004$),

268 usual activities (OR = 1.03, 95% CI 1.01 - 1.05, $p = 0.001$) and pain and discomfort (OR =

269 1.02, 95% CI 1.01 - 1.04, $p = 0.007$) domains. Being female increased the odds of reporting

270 problems in the pain and discomfort domain (OR = 1.47, 95% CI 1.11 - 1.95, $p = 0.008$).

271 A better organizational coordination experience increased the odds of a higher overall HRQOL

272 (OR = 1.87, 95% CI 1.18 - 2.95, $p = 0.007$) and reporting fewer health problems in the anxiety/

273 depression domain (OR = 0.36, 95% CI 0.20 - 0.63, $p < 0.0001$). No significant relation with

274 HRQOL was found for person-centeredness, clinical coordination or professional coordination.

275 The Hosmer-Lemeshow goodness-of-fit test p-values ranged between 0.35 and 0.81, suggestive

276 of well-fitting models. The variability ranged from 6 % for the pain/discomfort model

277 (Nagelkerke $R^2 = 0.06$) to 16 % for the mobility, self-care, and anxiety/ depression models

278 (Nagelkerke $R^2 = 0.16$) (see Table 3 and Figure 1).

279 [Insert Table 3] [Insert Figure 1]

Discussion
281 **Principle findings**

282 This study showed that patients who experienced good healthcare organizational coordination

283 were more likely to report a higher overall HRQOL and fewer anxiety and depression problems.

284 No association between person-centred, clinical and professional coordination experiences and

285 HRQOL in a general primary care practice population was found. Unemployment was

286 associated with poorer overall HRQOL, and aging was associated with mobility, self-care, usual

287 activity and pain problems. Also, female patients were more likely to report pain and discomfort

288 problems. On the other hand, patients who were married reported less anxiety and depression.

Comparison with other studies

To our knowledge, this is the first study to evaluate the association between integrated care and HRQOL in a general primary care practice population. Previous studies on integrated care and HRQOL have mainly focused on patient groups with specific chronic diseases [43], older populations [44] or on multimorbidity populations [45]. Furthermore, existing studies tend to lack a coherent theory and solid psychometric measurement tools to compare integrated care programs.

The results of the current study show a relationship between organisational coordination activities and HRQOL among adult patients in a general primary care practice context in the Netherlands. In contrast, earlier studies focused mainly on interventions aimed at coordinating care at clinical (e.g. self-management) and professional (e.g. multidisciplinary care) levels [10, 11, 44]. As such, it is possible to infer that patients in a primary care context may have a potential to gain in HRQOL if GPs devise efforts to improve the inter-organisational aspects of their integrated care programs. Previous research has indicated the lack of organizational capacity of Dutch primary care practices [5]. No relation between clinical and professional coordination and HRQOL was observed in the present study, which seems to be inconsistent with previous studies [15, 18, 19, 45, 46]. This discrepancy may be due to the fact that clinical and professional coordination have more influence on the perceived HRQOL of people with a chronic disease whereas the entire primary care practice population was included here. Therefore, information linking organisation coordination to improved HRQOL is hypothesis-generating and requires confirmation in further studies. Similarly, a person-centred care approach was not associated with HRQOL in this study, while aspects related to knowing and addressing patients' physical, psychological and social needs are considered an essential aspect of primary care service delivery [7, 21]. This could be explained by the complexity of patient needs in previous studies with (multiple) chronic conditions that require more tailored person-

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314 centred approaches in clinical encounters as compared to the general population, which was

315 included in this study. Therefore, further work is still required to explore the association

316 between person-centred care experiences and HRQOL in different patient groups.

317   As could be expected from previous studies [24-27], unemployment was associated with

318 a poorer HRQOL. This implicates that integrated care programs have to take into account that

319 social aspects like loneliness and financial constraints have an impact on the quality of life of

320 people in local communities. Aging was also associated with less mobility, reduced self-care,

321 usual activities and pain and discomfort problems, which is consistent with previous research

322 [22, 23]. However, no effect of aging was observed on overall HRQOL. This inconsistency

323 could be related to the sample composition whereby the entire primary practice population was

324 included while previous studies were limited to chronic disease populations. The present study

325 also corroborates that being female heightened the chance of a lower HRQOL[23, 27],

326 especially when evaluating pain and discomfort problems. The current results showed that

327 married participants had a higher overall HRQOL and reported fewer anxiety and depression

328 problems compared to singles, which is in accordance with a previous primary care study [26].

329 As such, GPs participating in integrated care programs should be aware of a possible

330 accumulation of these risk factors, notably for women living alone and who are unemployed.

331 To further understand the relationship between integrated care and HRQOL and these

332 sociodemographic determinants, more research is needed.

Strengths and limitations of this study

334 The strength of the present study is that it was grounded theoretically on the RMIC. The

335 explored association between integrated care and HRQOL was based on preliminary evidence

336 also grounded on the RMIC [5, 7, 11, 34-39]. Since thorough research into the effects of

337 integrated care at organisational levels is scarce [11], this study provides a unique and valuable

338 contribution to the existing knowledge of integrated primary care. Potentially boosting the

339 external validity of our findings was the use of a cross-sectional design in a general primary

340 care practice population. With regard to the used measures, firstly HRQOL was measured using

341 the EQ-5D, which is a generic measure applicable in a general practice population. The EQ-5D

342 has a good construct validity and is simpler to use and briefer than other HRQOL measures

343 [47]. Secondly, the RMIC-MT patient version is considered a brief, reliable, and validated

344 measurement tool to measure integrated care in routine practice [11]. The RMIC-MT patient

345 version is also considered to be the most comprehensive patient experience measure that

346 assesses all essential aspects of integrated care [39].

347   However, this study also has several limitations. First, due to the cross-sectional nature

348 of our study, the direction of the association between integrated care and HRQOL cannot be

349 established. It is unclear if differences in integrated care scores reflect actual differences in care

350 delivery or differences in the perception of care [10]. Moreover, the relatively small effect sizes

351 found in this study also suggest that the larger study samples are needed to further explore the

352 association between integrated care and HRQOL. A follow-up study with a more controlled

353 design (e.g. realist RCT's) with a larger sample will be beneficial to further explore and deepen

354 our understanding of the associations between integrated care and HRQOL. In future studies,

355 it would also be recommendable to independently assess the degree of integrated care from

356 various stakeholder perspectives (e.g. patient, care provider, manager, policymaker). In

357 addition to increasing external validity, the risk of confounders can be reduced by assessing

358 multiple perspectives. A second limitation is caused by the unavailability of routine health data.

359 As such, it was not possible to account for other factors (e.g. number of chronic diseases) that

360 might be associated with perceptions of care delivery and quality of life. Our study was

361 conducted among the general primary care practice population, so the logical next step would

362 be to replicate these analyses by exploring in depth the sociodemographic, care integration and

363 health data of people with a low HRQOL. Accordingly, future studies should consider other

364 outcome measures (e.g. service use, satisfaction, quality of care) as well as potential effect

365 modifiers of integrated care to explore the peculiarities of their relationship with HRQOL. A

366 third limitation of this study is the use of the EQ-5D-3L. Recent studies have indicated that the

367 EQ-5D-5L leads to more accurate measurement properties due to fewer ceiling effects,

368 especially in relation to mild health problems [48]. In addition, we dichotomised the TTO score

369 to explore differences in integrated care experiences between people with a good and poor

370 HRQOL. This might have led to an under- or overestimation, thus the current results should be

371 considered as hypothesis-generating for further longitudinal studies (e.g., realist RCTs)

372 exploring the relationship between integrated care and HRQOL. Fourth, our findings are limited

373 by selection bias inherent to the convenient sample of patients that participated in this study.

374 The participating primary care practices are restricted to a narrow geographical region in the

375 Netherlands. Moreover, the response rate of the present study is relatively low compared to

376 other patient survey studies in the Netherlands [30], which might have resulted in an

377 underestimation or overestimation of our results. Nevertheless, the results generated from this

378 relatively small sample will be useful to validate studies with a larger sample.

Implications for practice

380 The association between organisational integration and perceived quality of life found in this

381 study could be considered a first step forward to improving the inter-organisational capacity of

382 primary care practices. These findings reinforce the necessity of long-term policies and

383 incentives to enhance integrated primary care teams to meet the care needs of people in local

384 communities in the Netherlands. Further studies with a longitudinal design are needed to

385 evaluate the effect of integrated care activities within primary care services on HRQOL

386 measures. Moreover, future studies on the effectiveness of integrated care interventions must

387 consider local contextual characteristics of the studied population by uniting realist with

388 reductionist evaluation designs (e.g. realist RCTs) [10]. Often the context in which integrated

389 care interventions are implemented is overlooked. These studies are crucial as it will allow

390 policy makers to tailor the choice of interventions to the desired outcome, available resources,

391 and local healthcare context.

Conclusion

393 This is the first study to explore the association between integrated care and HRQOL from the

394 perspective of patients from a primary care practice population. The present study showed that

395 patients with a better organizational care coordination experience were more likely to have a

396 higher HRQOL. Unemployment and aging were associated with lower HRQOL, and people

397 who were married reported less anxiety and depression. Our findings underscore the importance

398 of enhancing the inter-organisational capacity of primary care practice when planning

399 interventions to improve the HRQOL of people in local communities.

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Authors Contributions

404 Author contributions were as follows. Study concept and design: PV; Acquisition, analysis, and

405 interpretation of the data: PV and MK; Drafting of the manuscript: PV; Critical revision of the

406 manuscript for important intellectual content: PV, MK, JH, RA; Statistical analysis: PV and

407 MK; Study supervision: PV and RA. All authors read and approved the final manuscript. PV

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Competing interests

414 The authors declare that they have no competing interests.

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415 **Data sharing statement**
416 No additional data available.

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538 **Figures**

539 **Figure 1: Association of integrated care and sociodemographic**
540 **characteristics with health-related quality of life (HRQOL)**

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544 **Tables**

545 **Table 1. Respondents' characteristics in the low and high HRQOL**
546 **group**

547

Variable	Low HRQOL group [a]	High HRQOL group [b]	Total	*P*
Sample size, n (%)	321 (41.7)	449 (58.3)	770 (100)	NS
Gender, n (%)[*]				
Male	121 (37.7)	228 (50.8)	349 (45.3)	<0.0001
Female	200 (62.3)	221 (49.2)	421 (54.7)	
Age (years), mean (SD)[±]	62.55 (15.64)	62.83 (13.43)	62.1 (14.4)	0.255
Marital status, n (%)[*]				
Married	204 (63.6)	334 (75.2)	538 (70.3)	0.001
Single	117 (36.4)	110 (24.8)	227 (29.7)	
Work status, n (%)[*]				
Employed	89 (30.3)	200 (46.4)	289 (39.9)	<0.0001
Unemployed	61 (20.7)	20 (4.6)	81 (11.2)	
Retired	144 (49)	211 (49)	355 (49)	
Integrated care, mean (SD)[±]				
Integrated care (RMIC-MT total)	3.68 (0.46)	3.77 (0.41)	3.73 (0.44)	0.011
Person-centeredness	3.23 (0.79)	3.30 (0.67)	3.27 (0.73)	0.329
Clinical coordination	4.05 (0.62)	4.11 (0.59)	4.09 (0.61)	0.201
Professional coordination	3.29 (0.57)	3.40 (0.49)	3.35 (0.54)	0.039
Organisational coordination	3.83 (0.46)	3.94 (0.44)	3.90 (0.46)	0.002
HRQOL, mean (SD)[±]				
TTO	0.70 (0.18)	0.99 (0.19)	0.86 (0.19)	<0.0001
EQ-VAS	64.29 (19.89)	85.94 (13.62)	76.91 (19.66)	<0.0001

548
549 Abbreviations: NS, not stated; HRQOL, Health related Quality of Life; RMIC-MT, Rainbow Model of Integrated Care

550 Measurement Tool; TTO, Time Trade-Off.

551 [a] TTO score < 0.86

552 [b] TTO score ≥ 0.86

553 [*] Chi-square test

554 [±] Mann-Whitney test

555
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557 **Table 2. Distribution of responses among the HRQOL dimensions**
558 **split for the low and high HRQOL groups**

559

Dimension	Level[#]	Low HRQOL group [a]	High HRQOL group [b]	Total	*P*
Mobility, n (%)[*]	1	147 (45.8)	427 (95.1)	735 (78.8)	<0.001
	2	171 (53.3)	22 (4.9)	195 (20.9)	
	3	3 (0.9)	0 (0.0)	3 (0.3)	
Self-care, n (%)[*]	1	289 (90)	449 (100)	899 (96.4)	<0.001
	2	31 (9.7)	0 (0.0)	33 (3.5)	
	3	1 (0.3)	0 (0.0)	1 (0.1)	
Usual activity, n (%)[*]	1	129 (40.2)	432 (96.2)	722 (77.4)	<0.001
	2	179 (55.8)	17 (3.8)	196 (21)	
	3	13 (4.0)	0 (0.0)	15 (1.6)	
Pain/discomfort, n (%)[*]	1	46 (14.3)	449 (100)	495 (53.1)	<0.001
	2	250 (77.9)	0 (0.0)	411 (44.1)	
	3	25 (7.8)	0 (0.0)	27 (2.9)	
Anxiety/depression, n (%)[*]	1	173 (2.2)	449 (100)	783 (83.9)	<0.001
	2	141 (43.9)	0 (0.0)	141 (15.1)	
	3	7 (2.2)	0 (0.0)	9 (1)	

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561 [#] Level definitions (1 no problem, 2 some/moderate problem and 3 extreme problem).

562 [a] TTO score < 0.86

563 [b] TTO score ≥ 0.86
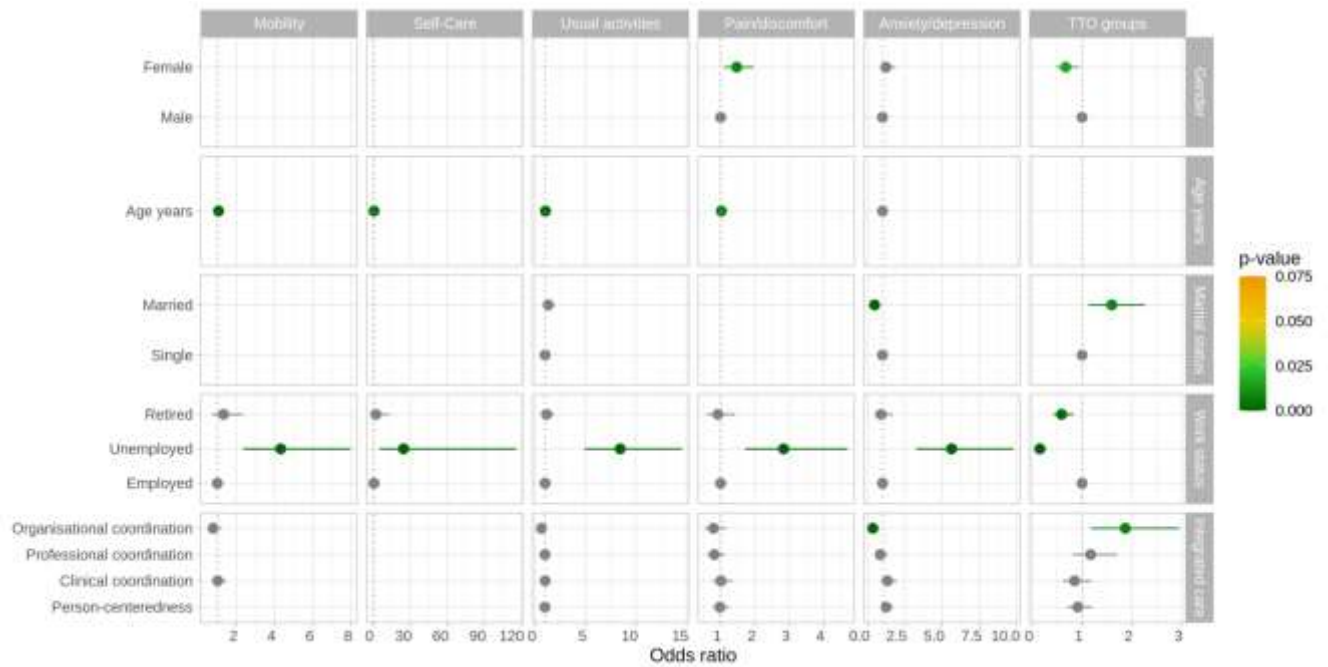
564 [*] Chi-square test

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Table 3. Bivariate and multivariate logistic regression analysis of integrated care and sociodemographic characteristics with HRQOL

Variable	Mobility Univariate OR (95% CI)	P	Mobility Multivariate OR (95% CI)	P	Self-Care Univariate OR (95% CI)	P	Self-Care Multivariate OR (95% CI)	P	Usual activities Univariate OR (95% CI)	P	Usual activities Multivariate OR (95% CI)	P	Pain/discomfort Univariate OR (95% CI)	P	Pain/discomfort Multivariate OR (95% CI)	P	Anxiety/depression Univariate OR (95% CI)	P	Anxiety/depression Multivariate OR (95% CI)	P	TTO groups Univariate OR (95% CI)	P	TTO groups Multivariate OR (95% CI)	P
Gender																								
Male	1		NA	NA	1		NA	NA	1		NA	NA	1		1		1		1		1		1	
Female	0.997 (0.73-1.37)	0.983	NA	NA	1.573 (0.79-3.14)	0.198	NA	NA	0.840 (0.62-1.15)	0.272	NA	NA	0.679 (0.52-0.88)	0.004	1.469 (1.11-1.95)	0.008	0.619 (0.43-0.89)	0.010	1.227 (0.81-1.87)	0.339	1.705 (1.27-2.28)	<0.001	0.67 (0.48-0.93)	0.016
Age (years)	1.056 (1.04-1.07)	<0.001	1.062 (1.04-1.09)	<0.001	1.047 (1.02-1.08)	0.002	1.061 (1.02-1.11)	0.004	1.014 (1.00-1.03)	0.014	1.034 (1.012-1.05)	0.001	1.008 (1.00-1.02)	0.86	1.022 (1.01-1.04)	0.007	0.980 (0.97-0.99)		1.002 (0.98-1.02)	0.829	0.997 (0.99-1.01)	0.493	NA	NA
Marital status																								
Single	1		NA	NA	1		NA	NA			1		1		NA	NA	1		1	<0.001	1		1	
Married	1.175 (0.837-1.65)	0.353	NA	NA	1.198 (0.58-2.49)	0.628	NA	NA	1.258 (0.90-1.75)	0.176	1.31 (0.90-1.90)	0.157	1.195 (0.90-1.90)	0.219	NA	NA	2.271 (1.58-3.26)		0.472 (0.31-0.72)	<0.001	0.574 (0.42-0.79)	0.001	1.598 (1.13-2.26)	0.008
Work status																								
Employed	1		1		1		1		1		1		1		1		1		1		1		1	
Unemployed	4.102 (2.30-7.33)	<0.001	4.311 (2.35-7.96)	<0.001	25.314 (5.50-116.49)	<0.001	24.849 (5.33-115.87)	<0.001	7.858 (4.67-13.22)	<0.001	8.426 (4.88-14.54)	<0.001	2.998 (1.84-4.88)	<0.001	2.834 (1.71-4.70)	<0.001	5.998 (3.56-10.10)		5.625 (3.24-9.76)	<0.001	0.146 (0.08-0.26)	<0.001	0.152 (0.08-0.28)	<0.001
Retired	4.236 (2.80-6.41)	<0.001	1.325 (0.74-2.36)	0.346	7.939 (1.83-34.45)	0.006	2.44 (0.46-12.83)	0.291	2.218 (1.51-3.25)	<0.001	1.13 (0.66-1.93)	0.656	1.355 (1.02-1.80)	0.036	0.924 (0.60-1.41)	0.716	0.936 (0.61-1.44)		0.905 (0.49-1.67)	0.750	0.652 (0.47-0.91)	0.010	0.590 (0.42-0.83)	0.002
Integrated care																								

Variable	Mobility				Self-Care				Usual activities				Pain/discomfort				Anxiety/depression				TTO groups			
	Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Person-centeredness	0.939 (0.76-1.17)	0.568	NA	NA	1.210 (0.75-1.95)	0.431	NA	NA	0.844 (0.68-1.04)	0.114	0.979 (0.73-1.31)	0.884	0.862 (0.72-1.03)	0.100	0.98 (0.78-1.24)	0.90	0.853 (0.67-1.08)		1.236 (0.89-1.72)	0.209	1.153 (0.95-1.41)	0.16	0.913 (0.70-1.20)	0.51
Clinical coordination	0.831 (0.64-1.07)	0.154	1.021 (0.72-1.45)	0.908	0.749 (0.44-1.28)	0.290	NA	NA	0.764 (0.59-0.97)	0.026	1.007 (0.71-1.43)	0.968	0.845 (0.68-1.05)	0.122	1.010 (0.76-1.34)	0.94	0.760 (0.57-1.01)		1.326 (0.88-1.97)	0.176	1.188 (0.94-1.51)	0.154	0.850 (0.61-1.19)	0.34
Professional coordination	1.004 (0.75-1.34)	0.976	NA	NA	1.242 (0.66-2.34)	0.501	NA	NA	0.772 (0.58-1.03)	0.077	0.982 (0.66-1.45)	0.927	0.694 (0.54-0.89)	0.003	0.82 (0.61-1.13)	0.225	0.637 (0.46-0.89)		0.854 (0.54-1.35)	0.498	1.484 (1.13-1.96)	0.005	1.173 (0.81-1.71)	0.40
Organisational coordination	0.722 (0.51-1.02)	0.064	0.777 (0.49-1.23)	0.278	0.703 (0.34-1.47)	0.35	NA	NA	0.58 (0.41-0.82)	0.002	0.643 (0.40-1.05)	0.076	0.710 (0.53-0.94)	0.019	0.792 (0.54-1.17)	0.243	0.430 (0.29-0.64)	<0.001	0.356 (0.20-0.63)	<0.001	1.720 (1.24-2.39)	0.001	1.869 (1.18-2.95)	0.007
Hosmer & Lemeshow R²	NA		0.49		NA		0.66		NA		0.62		NA		0.81		NA		0.76		NA		0.35	
Cox & Snell's R²	NA		0.10		NA		0.04		NA		0.09		NA		0.05		NA		0.10		NA		0.11	
Nagelkerke R²	NA		0.16		NA		0.16		NA		0.14		NA		0.06		NA		0.16		NA		0.14	

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For peer review only

Figure 1: Association of integrated care and sociodemographic characteristics with health-related quality of life (HRQOL)

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	2
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	#4	Present key elements of study design early in the paper	6

Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	6
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	7
Bias	#9	Describe any efforts to address potential sources of bias	14
Study size	#10	Explain how the study size was arrived at	6
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	7
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	7
Statistical methods	#12c	Explain how missing data were addressed	7
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	7
Statistical methods	#12e	Describe any sensitivity analyses	8

Results

Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	8

Participants	#13b	Give reasons for non-participation at each stage	8
Participants	#13c	Consider use of a flow diagram	NA
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	9
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	NA
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	9
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10
Main results	#16b	Report category boundaries when continuous variables were categorized	NA
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	11

Discussion

Key results	#18	Summarise key results with reference to study objectives	11
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	13
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	12
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14

Other Information

Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

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