

EMPIRICAL PAPER

Depressive Symptoms (Not Type D Personality) Predict Quality of Life in Survivors of Differentiated Thyroid Cancer

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Objective: Survivors of differentiated thyroid cancer (DTC) report impaired quality of life despite long duration of cure. Research regarding predictors of quality of life in this population has largely been limited to demographic characteristics. Type D personality (high levels of negative affect and social inhibition) is correlated with quality of life in other chronic illness populations, but has not been thoroughly assessed in survivors of DTC. Therefore, the present study assessed Type D personality as a predictor of quality of life in survivors of DTC. Depressive symptoms were controlled for in analyses to address concerns regarding conceptual similarity of Type D personality to depression.

Methods: Participants included survivors of DTC as registered in the Patient Reported Outcomes Following Initial Treatment and Long-term Survivorship (PROFILES) registry. Questionnaires on psychosocial functioning were mailed to 334 survivors. Data from eligible respondents ($N = 284$) were utilized in logistic regressions to assess relationships between Type D personality and quality of life domains.

Results: Type D personality did not predict physical, social, cognitive, or role functioning beyond what was predicted by depression. Type D personality did add to the prediction of impairment in emotional functioning at the .01 alpha level. Depression significantly predicted impaired quality of life across all measured domains. These findings were replicated across categorical and continuous measurement approaches.

Conclusions: Depressive symptoms robustly predict quality of life in survivors of DTC. Type D personality does not predict quality of life beyond what is accounted for by symptoms of depression in most quality of life domains.

Keywords: cancer; depression; thyroid; survivors; type D personality; quality of life

It is estimated that in 2015, there were over 765,000 individuals living with thyroid cancer in the United States, and it is projected that there will be 53,990 new cases diagnosed in 2018 (NCI, 2018). Approximately three times as many women as men are diagnosed with thyroid cancer each year (NCI, 2018). The vast majority of diagnosed thyroid carcinomas consist of differentiated thyroid cancer (DTC), which encompasses both papillary and follicular thyroid cancer. These cancers both originate from the thyroid follicular cells (Fagin & Nikiforov, 2013). Estimates suggest that these carcinomas account for over 90% of thyroid cancer diagnoses (Aschebrook-Kilfoy, Ward, Sabra, & Devesa, 2011). The median age of diagnosis for patients with thyroid cancer is 51-years-old with a five-year survival

rate of 98.1% (NCI, 2018). Thus, survivorship for these individuals may extend for many decades.

Despite the favorable prognosis, long-term survivors of DTC report impairments in quality of life. These include impairments in physical, emotional, role, cognitive, and social functioning, in addition to fatigue and vitality (Crevenna et al., 2003; Gamper et al., 2015; Hoftijzer et al., 2008; Husson et al., 2013; Lee et al., 2010; Tan et al., 2007). Evaluations of predictors of quality of life in this population have largely been limited to demographic and clinical variables. Only a few demographic factors (e.g., female sex, increased age, and unemployment) have been identified as potential risk factors for long-term impairment, as have thyroid cancer specific symptoms and fatigue (Crevenna et al., 2003; Husson et al., 2013; Lee et al., 2010; Tan et al., 2007). By contrast, many clinical variables, such as serum thyroid-stimulating hormone levels, have been largely found to be unrelated to quality of life (Hoftijzer et al., 2008).

A number of studies have reported that Type D personality (the combination of high levels of social inhibition

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and negative affect) is a predictor of quality of life in other chronic illness populations (Denollet, 2005). Surprisingly, this relationship has not been explored for survivors of DTC. Clinically, identifying relatively stable personality traits with the potential to affect patients over long courses of treatment may help inform continued assessment of quality of life for at-risk individuals. This is relevant for survivors of DTC, because understanding the impact of a characterological trait such as Type D personality may aid in the interpretation of reported distress and impairment throughout long-term follow-up treatment. Type D personality was first proposed as a risk factor for impaired quality of life and distress in cardiac patients, and was associated with increased risk for impaired emotional quality of life independent of depressive symptoms and New York Heart Association functional class (Pederson et al., 2010; Pederson & Denollet, 2003). Since then, Type D personality has also been demonstrated to predict impaired quality of life among patients with asthma and Parkinson's disease (Dubayova et al., 2013; Dubayova et al., 2009; Kim et al., 2014). Such findings have been replicated with oncology populations as well. For example, in a heterogeneous sample of endometrial cancer, colorectal cancer, lymphoma, and multiple myeloma survivors, those with Type D personality had lower levels of general health, social functioning, emotional functioning, and vitality, in addition to increased fatigue compared to control individuals (Mols et al., 2012). Similarly, among gastric cancer survivors, those with Type D personality have reported lower quality of life scores on role, emotional, cognitive, social, and global functioning scales, in addition to increased pain and fatigue compared with survivors without Type D personality (Zhang et al., 2016). Further, gastric cancer survivors with Type D personality exhibited higher levels of anxiety and depression compared to those who did not meet criteria for Type D personality (Zhang et al., 2016).

Although many studies have found that Type D personality significantly predicts health outcomes, several notable conceptual and psychometric concerns have been raised regarding the Type D personality construct. First, there is concern regarding construct overlap between Type D personality (specifically negative affect) and depression (Coyne & de Voogd, 2012; Ossola et al., 2015). That is, there appears to be considerable measurement overlap between the Type D personality construct and the traditional approaches to measuring patient mood, such as when using factor analytic methods (Coyne & de Voogd, 2012; Ossola et al., 2015). Additionally, concerns regarding replicability of demonstrated relationships between Type D personality and health variables invite concern regarding statistical methods used to evaluate the construct (Coyne & de Voogd, 2012). Critics have argued that Type D personality is best represented as a continuous construct (often measured by the interaction of negative affect and social inhibition), rather than as a categorical outcome (Ferguson et al., 2009). Thus, recent studies have begun to examine Type D as a continuous variable, and in some cases Type D personality has not emerged as a significant

predictor of health outcomes (e.g., Grande et al., 2011; Williams et al., 2012).

Given that DTC has low mortality and yet is sometimes associated with long-term distress and impairment, it is important to ask if Type D personality contributes to these negative outcomes. This is particularly important given the previous research demonstrating relationships between Type D personality and quality of life in other chronic illness populations. However, statistical and conceptual concerns regarding Type D personality raise important questions about the applicability of the construct. In particular, concerns regarding conceptual and statistical overlap with depression are essential to consider, as depression has been found to predict quality of life in thyroid cancer patients and other cancer populations (Badger et al., 2004; Howren et al., 2010; Pelletier et al., 2002; Smith et al., 2003; Tagay et al., 2006; Yen et al., 2006). Thus, the primary purpose of this study is to examine Type D personality as a predictor of quality of life among long-term survivors of DTC, beyond demographic characteristics and depressive symptomatology. Results will reveal whether Type D personality is a useful target for identification of survivors of DTC at risk for impaired quality of life. Additionally the study will provide needed information regarding the statistical contributions of Type D personality when depressive symptomatology is already known. It was hypothesized that Type D personality would predict impairment in quality of life across the tested domains. Type D personality was assessed both categorically and continuously in light of conflicting recommendations regarding measurement.

Methods

Participants

Participant data from the present study were obtained from a large, population-based survey mailed in 2010 by the Patient Reported Outcomes Following Initial Treatment and Long-term Evaluation of Survivorship (PROFILES) registry researchers (van de Poll-Franse et al., 2011). The PROFILES registry is linked with the Netherlands Cancer Registry, which collects clinical data for patients recently diagnosed with cancer in the Netherlands (Janssen-Heijnen et al., 2005). Data is de-identified and made available for analysis by outside researchers. Exclusion criteria for collection of thyroid cancer data is detailed elsewhere, but included cognitive impairment or other severe illness that precluded participation, unverifiable addresses, hospital declination of participation, and death prior to study commencement (Husson et al., 2013). The present study utilized all available data for survivors of papillary or follicular differentiated thyroid cancer ($N = 334$). Data included clinical and demographic information in addition to established psychosocial questionnaires, detailed below. The codebook for the large, population-based survey is included the study Replication Package. The present study was reviewed by the local institution's Institutional Review Board, and was deemed non-human subjects research.

Measures

Quality of Life

The European Organization for Research and Treatment of Cancer QLQ-C30 (QLQ-C30) was used to assess quality of life (Aaronson et al., 1993). The QLQ-C30 has five subscales, which correspond to domains in which survivors of DTC have reported relative deficits: physical, emotional, role, cognitive, and social functioning. Scores on each subscale range from 0-100, with higher scores representing better functioning. The QLQ-C30 has demonstrated high test re-test reliability with r values ranging from .82 to .91 (Hjermstad et al., 1995).

Type D Personality

The DS14 was used to assess for Type D personality (Denollet, 2005). The DS14 is a 14-item measure and consists of two seven-item subscales: negative affectivity and social inhibition. Psychometric properties for the DS14 are established with test-retest reliability of 0.72 for the negative affectivity subscale and 0.82 for social inhibition subscale (Denollet, 2005). Higher scores on each scale indicate greater symptomatology. According to Denollet, scores equal to or greater than 10 on both subscales indicate Type D personality. However, some studies have recommended scoring this measure continuously using a dimensional term comprised of the interaction between the negative affect and social inhibition subscales (e.g., Ferguson et al., 2009; Williams et al., 2012). Thus, the present study evaluated the impact of Type D personality on quality of life with Type D personality measured both categorically and continuously in separate analyses.

Depression

The Hospital Anxiety and Depression Scale (HADS) is a 14-item measure consisting of two 7-item subscales: anxiety and depression (Zigmond & Sniath, 1983). The depression subscale score was used as a control variable in analyses. This subscale has good internal consistency and test-retest reliability (Bjelland et al., 2002; Spinhoven et al., 1997). The depression variable was utilized both categorically using a cut-off score of eight and continuously (Bjelland et al., 2002). Higher scores represented greater symptomatology.

Analysis Plan

All analyses were conducted in SPSS Version 23. Data for the continuous quality of life scores were notably skewed ($z_{\text{skewness}} > 3.29$) and transformations resulted in data that remained non-normal (Tabachnick & Fidell, 2013). Therefore, logistic regressions were employed to evaluate study hypotheses consistent with previous studies (Mols et al., 2012). To prepare data for analysis via logistic regression, scores for the five measured quality of life domains were dichotomized using a cut-off of $-.5$ standard deviation below the mean of each respective domain. This cut off has been previously employed for studies of Type D personality, and is consistent with the threshold outlined by Norman and colleagues for identifying meaningful changes in health-related quality of life as assessed by

such instruments (Mols et al., 2012; Norman, Sloan, & Wyrwich, 2003). Scores $>.5$ standard deviations below the mean were considered impaired quality of life, and were coded as "1" in logistic regressions. All other scores were coded as "0."

Two sets of logistic regressions were performed. In the first, Type D personality and depression were both entered into the model as categorical variables. Demographic control variables (gender, age, and employment) were selected based on prior literature, and were included in block 1 of each logistic regression analysis. Then, depression (HADS depression scale) was entered into block 2 of the model, with scores greater than or equal to eight coded as positive for depressive symptoms. Lastly, the binary Type D personality variable was entered into the model in block 3, such that individuals scoring a 10 or above on both the negative affectivity and social inhibition subscales of the DS14 were coded as positive for Type D personality. Bonferroni corrections were employed to adjust for multiple comparisons (five sets of logistic regressions), such that that alpha levels $\leq .01$ were considered significant ($.05/5 = .01$). Following initial analyses, these logistic regressions and interpretation procedures were replicated with the exception that Type D personality and depression were entered as continuous rather than as categorical variables. Multicollinearity between the categorical Type D personality and depression variables, and the continuous Type D personality and depression variables, was evaluated and found not to be problematic for the current data based on the following guidelines: correlations between variables $< .8$, Variance Inflation Factors < 10 , Tolerance $> .1$ (Bowerman & O'Connell, 1990; Field, 2013; Myers, 1990).

Results

Sample Description

Of the 334 participants with a history of DTC invited to participate in the survey, 285 mailed back the survey ("Respondents"). One was excluded from analyses due to risk of traceability. Demographic and clinical characteristics of Respondents can be viewed in **Table 1**. There were no significant differences between respondents and non-respondents on the measured variables.

Univariate Analyses

Univariate outliers were identified utilizing an absolute value z-score cut-off of 3.29 (Field, 2013; Tabachnick & Fidell, 2013). There were no outliers identified for the continuous depression variable, and five identified for the continuous Type D personality variable. With regard to the quality of life variables, two outliers were identified for Physical Functioning, three for Emotional Functioning, zero for Role functioning, four for Cognitive functioning, and seven for Social functioning. Outliers were examined via histogram and frequency table, and all appeared to belong to either a positively skewed tail (for Type D personality), or a negatively skewed tail (for the five quality of life variables). Further, all outliers represented scores of worse functioning (higher scores on the Type D personality variable, or lower scores on quality

Table 1: Descriptive characteristics of participants (N = 284).

Gender	
Male	67 (23.6%)
Female	217 (76.4%)
Age at time of questionnaire (M, SD)	55.98 (14.12)
Age at diagnosis (M, SD)	46.31 (14.51)
Years since diagnosis (M, SD)	9.67 (5.36)
Tumor Type	
Papillary	216 (76.1%)
Follicular	68 (23.9%)
Stage at Diagnosis	
I	168 (59.2%)
II	51 (18.0%)
III	43 (15.1%)
IV	17 (6.0%)
Unknown	5 (1.8%)
Primary Treatment	
Surgery alone	67 (23.6%)
Surgery + ablation	207 (72.9%)
Surgery + radiotherapy	8 (2.8%)
Other	2 (0.7%)
Depression*	
HADS ≥ 8	32 (11.3%)
HADS < 8	234 (82.4%)
Unknown	18 (6.3%)
Type D Personality	
Yes	59 (20.8%)
No	214 (75.4%)
Unknown	11 (3.9%)
Partnership	
Partner	224 (78.9%)
No Partner	60 (21.1%)
Education Level	
High	76 (26.8%)
Middle	177 (62.3%)
Low	30 (10.6%)
Unknown	1 (0.4%)
Employment	
Employed	147 (51.8%)
Not Employed	132 (46.5%)
Unknown	5 (1.8%)

Note: * HADS depression scale cut-off is 8, with scores of 8 or higher coded positive for depressive symptoms.

of life functioning). Therefore, the data were retained in analysis so as not to exclude those individuals in the most severe distress. For each logistic regression, participants with missing data on analysis variables were excluded from the analysis.

Relationship between Type D Personality (Categorical) and Quality of Life

Separate logistic regressions were run for each of the five quality of life outcome variables. Logistic regression block and model results for Type D personality categorical data are displayed in **Table 2**, with statistics for predictor variables displayed in **Table 3**.

The block 1 model, which included the demographic control variables, was significant at the .01 alpha level for physical functioning only. The block 2 model, which included the dichotomized depression variable, was significant for all quality of life domains. The addition of depression significantly contributed to the model for all domains, as evidenced by significant χ^2 values at the block level. In block 3 Type D personality was entered as a categorical variable. The model remained significant for all domains of quality of life; however, the addition of Type D personality in block 3 contributed significantly to the model only for emotional functioning. Further, Type D personality was a significant predictor of impaired emotional functioning, but not of impairment in the other quality of life domains. By contrast, depression remained a significant predictor of impaired quality of life across all measured domains.

Collectively, these results suggest strong associations between depressive symptoms and quality of life for survivors of DTC. Type D personality predicted quality of life for emotional functioning, but not for physical, role, cognitive, or social functioning when controlling for demographic variables and depressive symptoms.

Relationship between Type D Personality (Continuous) and Quality of Life

Logistic regressions were computed for each of the five quality of life outcomes using continuous depression and Type D personality variables. Logistic regression block and model results for Type D continuous data are displayed in **Table 4**, with statistics for predictor variables displayed in **Table 5**.

The block 1 model, which included the demographic control variables, was significant at the .01 alpha level for physical functioning only. As in the categorical analyses, the block 2 model was significant for all quality of life domains, and the addition of depression significantly contributed to the model for all domains as evidenced by significant χ^2 values at the block level. In block 3 Type D personality was entered as a continuous variable. The model remained significant for all domains of quality of life; however, as in the categorical analyses the addition of Type D personality in block 3 did not contribute significantly to the model except in the case of emotional functioning. Depression remained a significant predictor of impaired quality of life across all measured domains,

Table 2: Logistic regression model and block results with depression and Type D as categorical predictors.

	Block 1 (Demographics)			Block 2 (Depression)			Block 3 (Type D Personality)							
	χ^2	df	p	χ^2	df	p	χ^2	df	p	N	$1R^2$	p	$1R^2$	
Physical Functioning														
Model	19.541	3	<.001	.107	51.084	4	255	<.001	.263	51.228	5	255	<.001	.263
Block	–	–	–	–	31.543	1	255	<.001	–	0.144	1	255	.705	–
Emotional Functioning														
Model	8.310	3	.040	.049	42.130	4	254	<.001	.232	53.124	5	254	<.001	.287
Block	–	–	–	–	33.819	1	254	<.001	–	10.994	1	254	.001	–
Role Functioning														
Model	8.867	3	.031	.048	21.460	4	255	<.001	.113	21.462	5	255	.001	.113
Block	–	–	–	–	12.593	1	255	<.001	–	0.002	1	255	.966	–
Cognitive Functioning														
Model	3.398	3	.334	.019	36.472	4	255	<.001	.191	37.163	5	255	<.001	.194
Block	–	–	–	–	33.074	1	255	<.001	–	0.690	1	255	.406	–
Social Functioning														
Model	2.396	3	.494	.014	30.011	4	257	<.001	.168	31.055	5	257	<.001	.173
Block	–	–	–	–	27.615	1	257	<.001	–	1.044	1	257	.307	–

Note: [†] Nagelkerke R^2 .

Table 3: Predictor statistic results with depression and Type D as categorical predictors.

		Block 2			Block 3		
		<i>B</i> (<i>SE</i>)	Wald	<i>Exp</i> (<i>B</i>)	<i>B</i> (<i>SE</i>)	Wald	<i>Exp</i> (<i>B</i>)
Physical Functioning	Gender [†]	0.365 (.397)	0.848	1.441	0.365 (.397)	0.848	1.441
	Employment [†]	0.772 (.397)	3.782	2.163	0.763 (.398)	3.685	2.145
	Age	0.023 (.014)	2.622	1.023	0.023 (.014)	2.614	1.023
	Depression [†]	2.438 (.473)	26.588**	11.454	2.394 (.486)	24.244**	10.957
	Type D [†]	–	–	–	0.146 (.383)	0.145	1.157
	Constant	–3.340 (.863)	14.961**	0.035	–3.362 (.866)	15.073**	0.035
Emotional Functioning	Gender	–0.202 (.398)	0.256	0.817	–0.180 (.409)	0.194	0.835
	Employment	0.724 (.411)	3.106	2.063	0.675 (.427)	2.506	1.964
	Age	–0.029 (.015)	3.787	0.972	–0.031 (.015)	3.981	0.970
	Depression	2.527 (.463)	29.727**	12.511	2.262 (.483)	21.900**	9.604
	Type D	–	–	–	1.253 (.370)	11.447**	3.500
	Constant	–0.231 (.816)	0.080	0.794	–0.424 (.844)	0.253	0.654
Role Functioning	Gender	0.190 (.348)	0.300	1.210	0.190 (.348)	0.300	1.210
	Employment	0.801 (.355)	5.093	2.229	0.800 (.356)	5.055	2.226
	Age	–0.006 (.013)	0.265	0.994	–0.006 (.013)	0.265	0.994
	Depression	1.459 (.420)	12.076**	4.300	1.454 (.435)	11.181**	4.279
	Type D	–	–	–	0.015 (.349)	0.002	1.015
	Constant	–1.157 (.719)	2.589	0.314	–1.160 (.722)	2.584	0.314
Cognitive Functioning	Gender	–0.328 (.356)	0.850	0.721	–0.326 (.357)	0.834	0.722
	Employment	–0.143 (.387)	0.136	0.867	–0.118 (.388)	0.092	0.889
	Age	–0.009 (.014)	0.428	0.991	–0.009 (.014)	0.446	0.991
	Depression	2.459 (.472)	27.151**	11.694	2.582 (.501)	26.552**	13.221
	Type D	–	–	–	–0.326 (.400)	0.664	0.722
	Constant	–0.448 (.761)	0.347	0.639	–0.395 (.764)	0.267	0.674
Social Functioning	Gender	0.135 (.394)	0.117	1.144	0.133 (.394)	0.114	1.142
	Employment	0.265 (.403)	0.434	1.304	0.235 (.406)	0.334	1.264
	Age	–0.006 (.014)	0.151	0.994	–0.005 (.014)	0.139	0.995
	Depression	2.177 (.426)	26.119**	8.815	2.066 (.438)	22.266**	7.894
	Type D	–	–	–	0.389 (.375)	1.077	1.476
	Constant	–1.519 (.814)	3.480	0.219	–1.593 (.821)	3.764	0.203

Note: * $p \leq .01$, ** $p \leq .001$.

[†]Dichotomous variables included gender (female = 1, male = 0), employment (employed = 0, unemployed = 1) depression (no depression = 0, depression = 1), and Type D personality (no Type D personality = 0, Type D personality = 1).

whereas Type D personality was a significant predictor only of impaired emotional functioning. Thus, the second set of logistic regressions corroborated findings from the categorical analyses.

Pearson’s correlations confirmed notable relationships between Type D personality and the HADS depression scale. The correlation between Type D personality and depression (both measured continuously) was significant ($r = .537, p < .001$), as were the relationships between negative affect and depression ($r = .549, p < .001$), and social inhibition and depression ($r = .341, p < .001$).

Discussion

Results from the present study revealed that Type D personality predicted quality of life only in the domain of emotional functioning after adjusting for depressive symptomatology. Type D personality was not predictive of other quality of life domains. By contrast, increased depressive symptomatology predicted quality of life scores for physical, emotional, role, cognitive, and social functioning. These results were replicated in both categorical and continuous analyses, and call into question the incremental validity of Type D per-

Table 4: Logistic regression model and block results with depression and Type D as continuous predictors.

	Block 1			Block 2			Block 3								
	χ^2	df	N	p	$\dagger R^2$	χ^2	df	N	p	$\dagger R^2$	χ^2	df	N	p	$\dagger R^2$
Physical Functioning															
Model	19.541	3	255	<.001	.107	69.668	4	255	<.001	.346	71.224	5	255	<.001	.353
Block	-	-	-	-	-	50.126	1	255	<.001	-	1.556	1	255	.212	-
Emotional Functioning															
Model	8.310	3	254	.040	.049	63.841	4	254	<.001	.337	76.241	5	254	<.001	.394
Block	-	-	-	-	-	55.531	1	254	<.001	-	12.400	1	254	<.001	-
Role Functioning															
Model	8.867	3	255	.031	.048	36.417	4	255	<.001	.187	38.027	5	255	<.001	.195
Block	-	-	-	-	-	27.550	1	255	<.001	-	1.611	1	255	.204	-
Cognitive Functioning															
Model	3.398	3	255	.334	.019	32.069	4	255	<.001	.169	32.456	5	255	<.001	.171
Block	-	-	-	-	-	28.670	1	255	<.001	-	0.388	1	255	.534	-
Social Functioning															
Model	2.396	3	257	.494	.014	52.715	4	257	<.001	.283	52.989	5	257	<.001	.284
Block	-	-	-	-	-	50.319	1	257	<.001	-	0.275	1	257	.600	-

Note: \dagger Nagelkerke R^2 .

Table 5: Predictor statistic results with depression and Type D as continuous predictors.

		Block 2			Block 3		
		<i>B</i> (<i>SE</i>)	Wald	<i>Exp</i> (<i>B</i>)	<i>B</i> (<i>SE</i>)	Wald	<i>Exp</i> (<i>B</i>)
Physical Functioning	Gender [†]	0.543 (.414)	1.718	1.720	0.539 (.413)	1.704	1.714
	Employment [†]	0.756 (.412)	3.369	2.130	0.835 (.417)	4.012	2.306
	Age	0.015 (.015)	0.968	1.015	0.011 (.015)	0.566	1.011
	Depression	0.362 (.058)	38.350**	1.436	0.404 (.069)	34.727**	1.497
	Type D	–	–	–	–0.002 (.002)	1.569	0.998
	Constant	–4.033 (.919)	19.259**	0.018	–3.862(.925)	17.415**	0.021
Emotional Functioning	Gender	0.009 (.426)	0.000	1.009	0.044 (.443)	0.010	1.045
	Employment	0.694 (.433)	2.567	2.002	0.656 (.460)	2.036	1.928
	Age	–0.043 (.016)	7.177*	0.958	–0.040 (.017)	5.253	0.961
	Depression	0.394 (.062)	40.606**	1.482	0.311 (.066)	21.965**	1.365
	Type D	–	–	–	0.008 (.002)	11.228**	1.008
	Constant	–0.782(.868)	0.812	0.457	–1.305 (.928)	1.978	0.271
Role Functioning	Gender	0.323 (.363)	0.795	1.382	0.319 (.363)	0.771	1.376
	Employment	0.770 (.366)	4.418	2.160	0.837 (.370)	5.121	2.309
	Age	–0.013 (.013)	0.972	0.987	–0.016 (.013)	1.448	0.984
	Depression	0.244 (.050)	23.904**	1.276	0.282 (.059)	22.712**	1.326
	Type D	–	–	–	–0.002 (.002)	1.606	0.998
	Constant	–1.580 (.756)	4.370	0.206	–1.415(.765)	3.427	0.243
Cognitive Functioning	Gender	–0.288 (.349)	0.678	0.750	–0.289 (.350)	0.682	0.749
	Employment	–0.107 (.378)	0.081	0.898	–0.072 (.381)	0.035	0.931
	Age	–0.017 (.013)	1.520	0.984	–0.018 (.014)	1.784	0.982
	Depression	0.249 (.050)	25.157**	1.283	0.268 (.059)	20.908**	1.307
	Type D	–	–	–	–0.001 (.002)	0.388	0.999
	Constant	–0.662 (.751)	0.778	0.516	–0.571 (.764)	0.558	0.565
Social Functioning	Gender	0.334 (.419)	0.636	1.397	0.333 (.419)	0.630	1.395
	Employment	0.160 (.426)	0.142	1.174	0.190 (.428)	0.197	1.210
	Age	–0.015 (.015)	0.963	0.985	–0.016 (.015)	1.127	0.984
	Depression	0.360 (.058)	39.006**	1.433	0.376 (.066)	32.278**	1.457
	Type D	–	–	–	–0.001 (.002)	0.275	0.999
	Constant	–2.204 (.879)	6.284	0.110	–2.128 (.888)	5.742	0.119

Note: * $p \leq .01$, ** $p \leq .001$.

[†]Dichotomous variables included gender (female = 1, male = 0), and employment (employed = 0, unemployed = 1).

sonality relative to depression in quality of life research (Haynes & Lench, 2003).

Recommendations for Future Research

While the current study replicates previous evidence that Type D personality predicts emotional quality of life even when controlling for depressive symptoms (e.g., Pederson et al., 2010), most studies have not controlled for depression in evaluating the impact of Type D personality on other areas of quality of life. Contrary to the current research, one study with a group of heterogeneous cancer survivors found impaired quality of life among those

with Type D personality even after controlling for depression (Mols et al., 2012). Thus, future research is needed to investigate these relationships in other oncology and chronic illness populations. This may be particularly important for populations in which significant relationships between Type D personality and quality of life have emerged in the past.

Results from the present study additionally support construct concerns regarding Type D personality. In particular, the construct has been criticized for its strong conceptual overlap with depression, in large part due to shared variance between the negative affect component

of Type D personality and depression (Coyne & de Voogd, 2012; Ossola et al., 2015). Indeed, depressive and negative affective symptoms were correlated in the present study ($r = .549$), raising questions regarding the degree of independence of the Type D personality construct from depression. Despite this, in most domains symptoms of depression, and not Type D personality, predicted quality of life among survivors of DTC. It is possible that negative affect and not social inhibition (or the combination of the two) predicts quality of life in this population. Future research may investigate this further.

Limitations

The present study was limited to investigation of quality of life among survivors of DTC only. Therefore, generalizations regarding the relationship between Type D personality and quality of life when controlling for depression are limited. Future research may also utilize a longitudinal rather than cross-sectional design for robust investigation of these relationships among chronic illness populations.

Clinical Implications

Clinical implications of the present study argue for continued screening for depressive symptoms among survivors of DTC, but do not support screening for Type D personality in this population. Depression screening may help identify individuals at risk for impairment across quality of life domains and is currently recommended for cancer patients, including during the transition to survivorship, and extensive clinical treatment guidelines for managing depression in patients with cancer exist (Andersen et al., 2014; Li et al., 2016). Had Type D personality emerged as a significant predictor of impaired quality of life for survivors of DTC, it would have yielded important information regarding a theoretically stable factor with the potential to affect treatment recommendations and health over the course of decades of survivorship. However, aside from the domain of emotional functioning, Type D personality was not predictive of quality of life after accounting for depression. Therefore, additional screening for Type D personality in this population would likely be of limited clinical utility. Importantly, assessing for a theoretically unmalleable personality trait (such as Type D personality), unless there is compelling evidence to do so, could ultimately delay effective case conceptualization and intervention by detracting focus from a mutable mood state that is more readily targeted in treatment. Therefore, results from the present study do not support assessing for Type D personality in addition to or instead of depression, when attempting to identify survivors of DTC at risk for impaired quality of life.

In summary, the present study demonstrated strong associations between depressive symptoms and various quality of life domains among survivors of DTC. Type D personality predicted quality of life only in the domain of emotional functioning. Collectively, these findings support continued depression screenings for survivors of DTC for potential referral when appropriate, and also suggest that screening for Type D has limited utility in this population.

Additional Files

The additional files for this article can be found as follows:

- **Supplementary File 1.** Analysis Package. DOI: <https://doi.org/10.5334/hpb.9.s1>
- **Supplementary File 2.** Replication Package. DOI: <https://doi.org/10.5334/hpb.9.s2>

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Competing Interests

The authors have no competing interests to declare.

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