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 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.

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.

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.

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
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 (PROFES) registry researchers (van de Poll-Franse et al., 2011). The PROFES 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-retest 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 & Snaith, 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; Spinthoven 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 ($z_{skewness} > 3.29$) 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
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 $\chi^2$ 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 $\chi^2$ 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) |
|--------------------------|-------------------------|----------------------|-----------------------------|
|                          | χ²          | df | N   | p    | R²    | χ²          | df | N   | p    | R²    | χ²          | df | N   | p    | R²    |
| Physical Functioning     |                          |                   |                              |                              |                   |                   |                              |                              |                   |                   |                              |                              |                   |
| Model                    | 19.541      | 3  | 255 | <.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  | 254 | .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  | 255 | .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  | 255 | .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  | 257 | .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 $R^2$. 
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 3: Predictor statistic results with depression and Type D as categorical predictors. |
|-----------------------------------------------|-----------------|---------|-----------|-----------------|---------|-----------|
| Physical Functioning                          | Gender$^1$      | 0.365 (.397) | 0.848 | 1.441 | 0.365 (.397) | 0.848 | 1.441 |
|                                               | Employment$^1$  | 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$^1$  | 2.438 (.473) | 26.588** | 11.454 | 2.394 (.486) | 24.244** | 10.957 |
|                                               | Type D$^1$      | –            | –     | –     | 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 | 2.626 (.483) | 21.900** | 9.604 |
|                                               | Type D          | –            | –     | –     | 1.253 (.370) | 11.447** | 3.500 |
|                                               | Constant        | –0.321 (.816) | 0.794 | 0.424 | –0.844 (.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) | 11.811** | 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) | 0.721 | –0.326 | –0.357 | 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: * $p \leq .01$, ** $p \leq .001$.

$^1$ 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).
Table 4: Logistic regression model and block results with depression and Type D as continuous predictors.

|                      | Block 1          | Block 2          | Block 3          |
|----------------------|------------------|------------------|------------------|
|                      | $\chi^2$ | df | N  | $^aR^2$ | $\chi^2$ | df | N  | $^aR^2$ | $\chi^2$ | df | N  | $^aR^2$ |
| Physical Functioning |                |                |                |          |          |          |          |          |          |          |          |          |
| Model                | 19.541          | 3  | 255 | <.001  | .107    | 69.668  | 4  | 255 | <.001  | .346    | 71.224  | 5  | 255 | <.001  | .353    |
| Block                | -                | -  | -   | -      | -       | -       | -  | 50.126 | <.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 | <.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 | <.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 | <.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 | <.001  | -       | 0.275   | 1  | 257 | .600   | -       |

Note: $^a$Nagelkerke $R^2$. 
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.

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

| Block 2 | Block 3 |
|---------|---------|
|         | $B$($SE$) | Wald  | Exp($B$) | $B$($SE$) | Wald  | Exp($B$) |
| Physical Functioning | | | | | | |
| Gender$^\dagger$ | 0.543 (.414) | 1.718 | 1.720 | 0.539 (.413) | 1.704 | 1.714 |
| Employment$^\dagger$ | 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 ≤ .01, **p ≤ .001.

$^\dagger$Dichotomous variables included gender (female = 1, male = 0), and employment (employed = 0, unemployed = 1).
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 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.

**References**

- Aaronson, N. K., Ahmedzai, S., Bergman, B., Bullinger, M., Cull, A., Duez, N. J., ... Takeda, F. (1993). The European Organization for Research and Treatment of Cancer QLQ-C30: A quality-of-life instrument for use in international clinical trials in oncology. *Journal of the National Cancer Institute, 85*(5), 365–376. DOI: https://doi.org/10.1093/jnci/85.5.365
- Andersen, B. L., DeRubeis, R. J., Berman, B. S., Gruman, J., Champion, V. L., Massie, M. J., ... Rowland, J. H. (2014). Screening, assessment, and care of anxiety and depressive symptoms in adults with cancer: An American Society of Clinical Oncology Guideline Adaptation. *Journal of Clinical Oncology, 32*(15), 1605–1619. DOI: https://doi.org/10.1200/JCO.2013.52.4611
- Aschebrook-Kilfoy, B., Ward, M. H., Sabra, M. M., & Devesa, S. S. (2011). Thyroid cancer incidence patterns in the United States by histologic type, 1992–2006. *Thyroid, 21*(2), 125–134. DOI: https://doi.org/10.1089/thy.2010.0021
- Badger, T. A., Braden, C. J., Mishel, M. H., & Longman, A. (2004). Depression burden, psychological adjustment, and quality of life in women with breast cancer: Patterns over time. *Research in Nursing & Health, 27*(1), 19–28. DOI: https://doi.org/10.1002/nur.20002
- Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the hospital anxiety and depression scale: An updated literature review. *Journal of Psychosomatic Research, 52*(2), 69–77. DOI: https://doi.org/10.1016/S0022-3999(01)0099-3
- Bowerman, B. L., & O’Connell, R. T. (1990). *Linear statistical models: An applied approach* (2nd ed.). Belmond, CA: Duxbury.
- Coyne, J. C., & de Voogd, J. N. (2012). Are we witnessing the decline effect in the Type D personality literature? What can be learned? *Journal of Psychosomatic Research, 73*(6), 401–407. DOI: https://doi.org/10.1016/j.jpsychores.2012.09.016
Crevenna, R., Zettng, G., Keilani, M., Posch, M., Schmidinger, M., Pirich, C., ... Dudczak, R. (2003). Quality of life in patients with non-meta-
static differentiated thyroid cancer under thyroxine supplemen-
tations therapy. Support Care in Cancer, 11(9), 597–603. DOI: https://doi.org/10.1007/s00520-003-0474-4

Denollet, J. (2005). DS14: Standard assessment of negative affectivity, social inhibition, and type D personality. Psychosomatic Medicine, 67(1), 89–97. DOI: https://doi.org/10.1097/01.psy.0000149256.81953.49

Dubayova, T., Krokavcova, M., Nagyova, I., Rosenberger, J., Gdovinova, Z., Middel, B., ... van Dijk, J. P. (2013). Type D, anxiety, and depression in association with quality of life in patients with Parkinson’s disease and patients with multiple sclerosis. Quality of Life Research, 22(6), 1353–1360. DOI: https://doi.org/10.1007/s11136-012-0257-9

Dubayova, T., Nagyova, I., Havlikova, E., Rosenberger, J., Gdovinova, Z., Middel, B., ... Groothoff, J. W. (2009). The association of type D personality with quality of life in patients with Parkinson's disease. Aging & Mental Health, 13(6), 905–912. DOI: https://doi.org/10.1080/13607860903046529

Fagin, J. A., & Nikiforov, Y. E. (2013). Molecular genetics of tumors of thyroid follicular cells. In L. E. Braverman & D. Cooper (Eds.), Werner & Ingbar's The Thyroid: A Fundamental and Clinical Text (10th ed., pp. 682–702). Philadelphia: Lippincott, Williams & Wilkins, a Wolters Kluwer business.

Ferguson, E., Williams, L., O'Connor, R., Howard, S., Hughes, B., Johnston, D., ... O'Carroll, R. (2009). A taxometric analysis of Type-D personality. Psychosomatic Medicine, 71(9), 981–986. DOI: https://doi.org/10.1097/PSY.0b013e3181bd888b

Field, A. (2013). Discovering statistics using IBM SPSS statistics (4th ed). Sage Publications, Ltd.

Gamper, E.-M., Wintner, L. M., Rodrigues, M., Buxbaum, S., Nilica, B., Singer, S., Giesinger, J. M., ... & Virgolini, I. (2015). Persistent quality of life impairments in differentiated thyroid cancer patients: Results from a monitoring programme. European Journal of Nuclear Medicine and Molecular Imaging, 42(8), 1179–1188. DOI: https://doi.org/10.1007/s00259-015-3022-9

Grande, G., Romppel, M., Vesper, J.-M., Schubmann, R., Glaesmer, H., & Hermann-Lingen, C. (2011). Type D personality and all-cause mortality in cardiac patients-data from a German cohort study. Psychosomatic Medicine, 73(7), 548–556. DOI: https://doi.org/10.1097/PSY.0b013e318227a9bc

Haynes, S. N., & Lench, H. C. (2003). Incremental validity of new clinical assessment measures. Psychological Assessment, 15(4), 456–466. DOI: https://doi.org/10.1037.1040-3590.15.4.456

Hjemstad, M. J., Fossa, S. D., Bjordal, K., & Kaasa, S. (1995). Test/retest study of the European organization for research and treatment of cancer core quality-of-life questionnaire. Journal of Clinical Oncology, 13(5), 1249–1254. DOI: https://doi.org/10.1200/JCO.1995.13.5.1249

Hofijzer, H. C., Heemstra, K. A., Corssmit, E. P. M., van der Klauw, A. A., Romijn, J. A., & Smit, J. W. A. (2008). Quality of life in cured patients with differentiated thyroid carcinoma. Journal of Clinical Endocrinology & Metabolism, 93(1), 200–203. DOI: https://doi.org/10.1210/jc.2007-1203

Houwen, M. B., Christensen, A. J., Karnell, L. H., & Funk, G. F. (2010). Health-related quality of life in head and neck cancer survivors: Impact of pre-
treatment depressive symptoms. Health Psychology, 29(1), 65–71. DOI: https://doi.org/10.1037/a0017788

Husson, O., Haak, H. R., Buffart, L. M., Nieuwlaat, W.-A., Oranje, W. A., Mols, F., ... van de Poll-Franse, L. V. (2013). Health-related quality of life and disease specific symptoms in long-term thyroid cancer survivors: A study from the popu-
lization-based PROFILES registry. Acta Oncologica, 52, 249–258. DOI: https://doi.org/10.3109/0284086X.2012.741326

Janssen-Heijnen, M. L. G., Louwman, W., van de Poll-Franse, L. V., & Coebergh, J. (2005). Results of 50 years cancer registry in the South of the Nether-
lands: 1955–2004 (in Dutch). Eindhoven: Eind-
hoven Cancer Registry.

Kim, S. R., Kim, H. K., Kang, J. H., Jeong, S. H., Kim, H. Y., Kim, S. R., & Kim, M. Y. (2014). Does Type D personal-
ality affect symptom control and quality of life in asthma patients? Journal of Clinical Nursing, 24, 739–748. DOI: https://doi.org/10.1111/jocn.12667

Lee, J. I., Kim, S. H., Tan, A. H., Kim, H. K., Jang, H. W., Hur, K. Y., ... Kim, S. W. (2010). Decreased health-
related quality of life in disease-free survivors of differentiated thyroid cancer in Korea. Health and Quality of Life Outcomes, 8(101). DOI: https://doi.
org/10.1186/1477-7525-8-101

Li, M., Kennedy, E. B., Byrne, N., Gérin-Lajoie, C., Katz, M. R., Keshavarz, H., Sellick, S., & Green, E. (2016). Management of depression in patients with cancer: A clinical practice guideline. Journal of Oncology Practice, 12(8), 747–756. DOI: https://doi.org/10.1001/jop.2016.01072

Mols, F., Thong, M. S. Y., van de Poll-Franse, L. V., Rouk-
ema, J. A., & Denollet, J. (2012). Type D (distressed) personality is associated with poor quality of life and mental health among 3080 cancer survivors. Journal of Affective Disorders, 136, 26–34. DOI: https://doi.
org/10.1016/j.jad.2011.08.034

Myers, R. (1990). Classical and modern regression with applications (2nd Ed.). Boston, MA: Duxbury.

National Cancer Institute. (2018). SEER Cancer Stat Facts: Thyroid Cancer. Bethesda, MD. https://seer. cancer.gov/statfacts/html/thyro.html

Norman, G., Sloan, J. A., & Wyrwich, K. (2003). Interpretation of changes in health-related quality of life: The remarkable universality of half a standard devi-
ation. Medical Care, 41(5), 582–592. DOI: https://doi.
org/10.1097/01.MLR.0000062554.74615.4C
Wiener et al: Depressive Symptoms (Not Type D Personality) Predict Quality of Life in Survivors of Differentiated Thyroid Cancer

Ossola, P., Panfilis, C. D., Tonna, M., Ardissino, D., & Marchesi, C. (2015). DS14 is more likely to measure depression rather than a personality disposition in patients with acute coronary syndrome. Scandinavian Journal of Psychology, 56(6), 685–692. DOI: https://doi.org/10.1111/sjop.12244

Pederson, S. S., & Denollet, J. (2003). Type D personality, cardiac events, and impaired quality of life: A review. European Journal of Cardiovascular Prevention and Rehabilitation, 10, 241–248. DOI: https://doi.org/10.1097/00014983-200308000-00005

Pederson, S. S., Herrmann-Lingen, C., Jonte, P. D., & Scherer, M. (2010). Type D personality is a predictor of poor emotional quality of life in primary care heart failure patients independent of depressive symptoms and New York Heart Association functional class. Journal of Behavioral Medicine, 33, 72–80. DOI: https://doi.org/10.1007/s10865-009-9236-1

Pelletier, G., Verhoef, M. J., Khatri, N., & Hagen, N. (2002). Quality of life in brain tumor patients: The relative contributions of depression, fatigue, emotional distress, and existential issues. Journal of Neuro-Oncology, 57, 41–49. DOI: https://doi.org/10.1023/A:10152758225642

Smith, E. M., Gomm, S. A., & Dickens, C. M. (2003). Assessing the independent contribution to quality of life from anxiety and depression in patients with advanced cancer. Palliative Medicine, 17, 509–513. DOI: https://doi.org/10.1019/151728822315

Spinthoven, P. H., Ormel, J., Sloekers, P. P. A., Kempen, G. I. J. M., Speckens, A. E. M., & Van Hemert, A. M. (1997). A validation study of the hospital anxiety and depression scale (HADS) in different groups of Dutch subjects. Psychological Medicine, 27, 363–370. DOI: https://doi.org/10.1017/S0033291796004382

Tabachnick, B. G., & Fidell, L. S. (2013). Using multivariate statistics (6th ed.). Pearson Education, Inc.

Tagay, S., Herpertz, S., Langkafel, M., Erim, Y., Bockisch, A., Senf, W., & Görges, R. (2006). Health-related quality of life, depression and anxiety in thyroid cancer patients. Quality of Life Research, 15(4), 695–703. DOI: https://doi.org/10.1007/s11136-005-3689-7

Tan, L. G. L., Nan, L., Thumboo, J., Sundram, F., & Tan, L. K. S. (2007). Health-related quality of life in thyroid cancer survivors. Laryngoscope, 117(3), 507–510. DOI: https://doi.org/10.1097/MLG.0b013e31802e3739

van de Poll-Franse, L. V., Horevoort, N., van Eenbergen, M., Denollet, J., Roukema, J. A., Aaronsen, N. K., … Mols, F. (2011). The Patient Reported Outcomes Following Initial treatment and Long term Evaluation of Survivorship registry: Scope, rationale and design of an infrastructure for the study of physical and psychosocial outcomes in cancer survivorship cohorts. European Journal of Cancer, 47(14), 2188–2194. DOI: https://doi.org/10.1016/j.ejca.2011.04.034

Williams, L., O’Connor, R. C., Grubb, N. R., & O’Carroll, R. E. (2012). Type D personality and three-month psychosocial outcomes among patients post-myocardial infarction. Journal of Psychosomatic Research, 72(6), 422–426. DOI: https://doi.org/10.1016/j.jpsyr.2012.02.007

Yen, J.-Y., Ko, C.-H., Yen, C.-F., Yang, M.-J., Wu, C.-Y., Juan, C. H., & Hou, M.-F. (2006). Quality of life, depression, and stress in breast cancer women outpatients receiving active therapy in Taiwan. Psychiatry and Clinical Neurosciences, 60(2), 147–153. DOI: https://doi.org/10.1111/j.1440-1819.2006.01479.x

Zhang, J.-K., Fang, L.-L., Zhang, D.-W., Jin, Q., Wu, X.-M., Liu, J.-C., Zhang, C.-D., & Dai, D.-Q. (2016). Type D personality with gastric cancer survivors: Association with poor quality of life, overall survival, and mental health. Journal of Pain and Symptom Management, 52(1), 81–91. DOI: https://doi.org/10.1016/j.jpainsymman.2015.12.042

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. Acta Psychiatrica Scandinavica, 67(6), 361–370. DOI: https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

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