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Receipt and Predictors of Psychosocial Services Following Distress Screening among Cancer Patients

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# Receipt and Predictors of Psychosocial Services Following Distress Screening among Cancer Patients

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requirements for the degree Doctor of Philosophy

in

Clinical Psychology

by

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2019

# DEDICATION

This dissertation is dedicated to Beverly Hathaway and family, Andrew Ustjanauskas and family, Alana Cosgrove and family, the OPC, Andrew Bache, Kerry McAuliffe, Tonya Pan-Weisz, and Kate Conover, whose unconditional and endless support has allowed me to move in the direction of my values.

# TABLE OF CONTENTS

Signature Page………………………………………………………………… iii

Dedication……………………………………………………………………... iv

Table of Contents…………………………………………………………... v

List of Figures……………………………………………………………..... vii

List of Tables……………………………………………………………….. viii

Acknowledgements………………………………………………………… ix

Vita……………………………………………………………………............ x

Abstract of the Dissertation…………………………………………………… xi

Introduction………………………………………………………………… 1
- Psychosocial Distress in Cancer Patients……………………………...... 1
- Distress Screening Standards and Guidelines…………………………... 2
- Implementation of Distress Screening………………………………….. 5
- Effectiveness of Distress Screening…………………………………….. 6
  - Distal outcomes………………………………………………………… 6
  - Proximal outcomes…………………………………………………....... 11
  - Medial outcomes……………………………………………………….. 13
    - Patient-provider communication…………………………………….. 13
    - Receipt of referral…………………………………………………… 14
    - Receipt of psychosocial services…………………………………….. 15
      - U.S. studies reporting receipt of psychosocial services………….. 17
      - Non-U.S. studies reporting receipt of psychosocial services…….. 20
      - Limitations of studies reporting receipt of psychosocial services... 23
- Systems Theory………………………………………………………… 27
- Summary and Aims………………………………………………………... 28

Method……………………………………………………………………….. 32
- Distress Screening and Triage Process and Documentation……………. 33
- Data Retrieval and Variables…………………………………………… 37
  - Patient and clinical factor variables…………………………………… 38
  - Health system factor variables………………………………………… 38
  - Outcome variables………………………………………………………. 38
- Data Analyses…………………………………………………………….... 42
  - Analyses for Specific Aim 1……………………………………………….. 42
  - Analyses for Specific Aim 2……………………………………………….. 43

        Analyses for Specific Aim 3………………………………….………….. 44
        Analyses for Specific Aims 4a and 4b……………………………………… 46
        Analyses for Specific Aims 5a and 5b…………………………………...…. 49

Results…….………………………….…………..………………………… 52
    Specific Aims 1 and 2………………………………….………..………… 52
    Specific Aim 3……………………………….………..………………..... 58
    Specific Aim 4……………………………….………..………………..... 62
    Specific Aim 5……………………………….………..………………..... 63

Discussion……………………………….…………..………………..…….. 66

Appendix 1: Figures…………………………….………..……..……………. 78

Appendix 2: Tables…………………………….………..…...………………... 81

References……………………………….…………..………………..…….. 106

# LIST OF FIGURES

Figure 1. Medical Record Abstraction Form……………………………………….. 78

Figure 2. Automated triaging actions and distress screening outcomes, for each type of automated notification generated………………………………………... 79

Figure 3. Automated triaging actions and distress screening outcomes, for all automated notifications combined……………………………………………….. 80

# LIST OF TABLES

Table 1. Variables and Descriptions………………………………………………….. 81

Table 2. Participant Characteristics………………………………………………… 92

Table 3. Types of Automated Triaging Actions Generated by SupportScreen…….. 94

Table 4. Number of Automated Notifications that Needed Follow-up…………….. 95

Table 5. Receipt of Appropriate Psychosocial Contacts and Services, Calculated for All Automated Notifications Combined…………………………………….. 96

Table 6. Time to Receipt of First Appropriate Psychosocial Contacts and Services, Calculated for All Automated Notifications Combined…...……………………….. 97

Table 7a. Point-Biserial Correlations Between Continuous Patient, Clinical, and Health System Factors and Dichotomous Outcome Variables…...………………… 98

Table 7b. Chi-Square Tests Between Dichotomous/Categorical Patient and Clinical Factors and Dichotomous Outcome Variables..…………………………... 99

Table 7c. Pearson Correlations Between Continuous Patient, Clinical, and Health System Factors and Continuous Outcome Variables……………………………….. 100

Table 7d. Point-Biserial Correlations Between Dichotomous Patient and Clinical Factors and Continuous Outcome Variables……………………………………….. 101

Table 7e. Analysis of Variance Tests Between Categorical Patient, Clinical, and Health System Factors and Continuous Outcome Variables……………...………... 102

Table 8. Logistic Regression Statistics for Model 1….…………………………… 103

Table 9. Cox Regression Statistics for Model 9…………………………………… 104

Table 10. Chi-Square Tests Characterizing Dichotomized Patient, Clinical, and Health System Factors and the Outcome Variable Receipt of At Least One Appropriate Psychosocial Service…………………………………...…………... 105

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# ABSTRACT OF THE DISSERTATION

## Receipt and Predictors of Psychosocial Services Following Distress Screening among Cancer Patients

by

Amy E. Ustjanauskas

Doctor of Philosophy in Clinical Psychology

University of California San Diego, 2019
San Diego State University, 2019

Professor Vanessa L. Malcarne, Chair
Professor Kristen J. Wells, Co-Chair

**Rationale.** Distress screening is recognized as a standard of practice to address the psychosocial needs of distressed cancer patients. Experts point to receipt of psychosocial care as a critical factor in successful implementation of distress screening programs; however, research in this area is limited. The current study evaluated receipt of psychosocial care following distress screening at a comprehensive cancer center by documenting rates at which distressed cancer patients received psychosocial contacts and services, documenting time to receipt of contacts and services, and identifying which patient, clinical, and health system factors predict receipt and timing of contacts and services following distress screening.

**Design.** A retrospective secondary data analysis of clinical and medical record data for 149 cancer patients routinely screened for distress during a one-month period in 2016 at a comprehensive cancer center was conducted.

**Results.** Of the 149 patients included in this study, 146 (97.99%) were identified as distressed. All 146 distressed patients received automated printed educational materials and at least one automated notification for a psychosocial provider. Of the 103 patients identified as needing follow-up by a psychosocial provider, 61.17% and 10.68% received at least one appropriate psychosocial contact and service, respectively; 44.66% and 4.85% received at least the majority of appropriate psychosocial contacts and services, respectively; and 17.48% and 2.91% received all appropriate psychosocial contacts and services, respectively. On average, patients received contacts and services in 8.19 and 4.82 days, respectively. Number of automated notifications and type of first appropriate psychosocial contact predicted receipt of at least one appropriate psychosocial contact and time to receipt of first appropriate psychosocial contact, respectively.

**Conclusions.** The current study addressed major gaps in the distress screening literature by evaluating receipt of appropriate aftercare following distress screening. While all patients screened and identified as distressed received automated printed educational materials, only some patients received appropriate psychosocial contacts, and few received

appropriate psychosocial services following distress screening. It is imperative that future research evaluate receipt, timing, and predictors of psychosocial contacts and services following distress screening, in order to improve distress screening processes nationwide and better meet the psychosocial needs of distressed cancer patients.

# Receipt and Predictors of Psychosocial Services Following Distress Screening among Cancer Patients

Cancer is a major public health problem. It is the second leading cause of death in the United States accounting for approximately 600,000 deaths each year (National Center for Health Statistics, 2017; American Cancer Society, 2019). It is projected that in 2019 nearly 1.7 million new cancer cases will be diagnosed (American Cancer Society, 2019). By 2024, it is anticipated that nearly 19 million people will be living beyond a cancer diagnosis (National Cancer Institute, 2017).

## Psychosocial Distress in Cancer Patients

Psychosocial distress is a broad construct encompassing a wide array of components. It has been defined as "a multifactorial experience of a psychological (i.e., cognitive, behavioral, emotional), social, spiritual, and/or physical nature that may interfere with [a patient's] ability to cope effectively with cancer, its physical symptoms, and its treatment" (National Comprehensive Cancer Network, 2017, p. 7). Distress can include unpleasant emotional experiences such as sadness, worry, fear, social isolation, and existential and spiritual crisis; subclinical and clinical levels of anxiety and depression; as well as non-psychiatric practical concerns (Mitchell, 2013; National Comprehensive Cancer Network, 2017). Distress was conceptualized in this way to reduce stigma and increase acceptability of screening among cancer patients (Mitchell, 2013; National Comprehensive Cancer Network, 2017).

Distress among cancer patients is common (Linden & Girgis, 2012). It is estimated that approximately 35% of cancer patients experience distress, broadly defined, and 19%

and 13% meet clinical levels of anxiety and depression, respectively (Linden & Girgis, 2012; Zabora, Brintzenhofeszoc, Curbow, Hooker, & Piantadosi, 2001). Psychosocial distress has been shown to negatively impact quality of life, satisfaction with health care, adherence to treatment, immune function, and health outcomes among cancer patients (Carlson, Waller, & Mitchell, 2012; Holland et al., 2010; McCarter et al., 2015; Mitchell, 2015). Psychosocial distress in cancer patients, however, has historically not been assessed in a systematic fashion in oncology settings (Bidstrup, Johansen, & Mitchell, 2011).

## Distress Screening Standards and Guidelines

Distress screening, a process whereby patients are assessed for distress and connected to psychosocial interventions designed to reduce distress, has been identified as a way to address the psychosocial needs of cancer patients (American College of Surgeons, 2012; Institute of Medicine, 2008; National Comprehensive Cancer Network, 2017). Major national organizations have recognized distress screening as a standard of practice, including the Institute of Medicine (IOM), the National Comprehensive Cancer Network (NCCN), and the American College of Surgeons (AcoS) Commission on Cancer (CoC) (American College of Surgeons, 2012; Institute of Medicine, 2008; National Comprehensive Cancer Network, 2017).

In 1997, the NCCN created an interdisciplinary panel comprised of individuals from oncology, nursing, social work, psychiatry, psychology, and clergy to develop clinical practice guidelines for distress management in oncology settings (National Comprehensive Cancer Network, 2017). The work of the NCCN panel served as the foundation for an IOM report released in 2007 entitled, *Cancer Care for the Whole*

*Patient: Meeting Psychosocial Health Needs* (Institute of Medicine, 2008). This IOM report solidified psychosocial care as a standard of quality cancer care. In the report, the IOM called for an integration of distress screening into cancer care to address the psychosocial needs of cancer patients. Specifically, they recommended a combination of activities to improve quality cancer care. That is, they recommended the integration of distress screening accompanied by other best practices including case management and follow-up treatment (Institute of Medicine, 2008).

Following the formation of the NCCN panel, the NCCN also began releasing formal clinical practice guidelines that outline standards of care for distress management in cancer care (National Comprehensive Cancer Network, 2017). Their most recently issued guidelines, the *NCCN Clinical Practice Guidelines in Oncology: Distress Management Version 1.2017*, indicated "patients should be screened for distress at every medical visit as a hallmark of patient centered care. At a minimum, patients should be screened for distress at their initial visit, at appropriate intervals, and as clinically indicated, especially with changes in disease status" (National Comprehensive Cancer Network, 2017, p. 8). In the context of distress screening, the NCCN also recommends that patients be screened for distress in all settings, at all disease stages, according to clinical practice guidelines, and that both the level and nature of distress be identified through screening. Further, the NCCN recommends as a standard of care that distress screening be accompanied by readily available and adequately reimbursable treatment provided by individuals experienced in psychosocial cancer care. The NCCN recommends that institutional committees be formed and training be conducted in the context of implementing distress screening programs. The NCCN also recommends that quality improvement and other evaluation projects be implemented to measure outcomes of distress screening (National Comprehensive Cancer Network, 2017).

Further, the AcoS CoC issued a set of standards in 2012, *Cancer Program Standards 2012: Ensuring Patient-Centered Care V1.2.1*, including standard 3.2, *Psychosocial Distress Screening*, which was designed to facilitate the inclusion of distress screening and referral to psychosocial services as a standard of care in oncology settings (American College of Surgeons, 2012). Notably, the AcoS CoC standards indicated that by 2015 accredited cancer centers are required to implement a distress screening process as a standard of care (American College of Surgeons, 2012). Specifically, AcoS CoC standards indicated that "all cancer patients must be screened for distress a minimum of one time at a pivotal medical visit" (American College of Surgeons, 2012; Commission on Cancer, 2016). The AcoS CoC specified that the cancer committee at each cancer center is to define the pivotal medical visit and choose the specific screening tool as well as its mode of administration and designated clinical cutoff used to identify distressed patients; tools with strong psychometric properties were recommended. The AcoS CoC's standards also indicated that individuals involved in the administration and interpretation of distress screening must be properly trained; results of distress screening must be discussed with patients at a face-to-face medical visit; and that those individuals evidencing moderate-to-severe distress must be assessed by a member of the oncology team whom will determine appropriate referrals and resources. Further, the standards indicated that the psychosocial services coordinator of the cancer committee is to oversee the distress screening process and report the following metrics to the cancer committee annually: number of patients screened and referred for distress resources or further follow up; and where patients were referred (American College of Surgeons, 2012; Commission on Cancer, 2016).

**Implementation of Distress Screening**

As a result of major national organizations issuing guidelines and standards promoting distress screening, cancer centers across the country have adopted distress screening programs. However, implementation has been variable due to several factors including the broad nature of the definition of distress and the lack of explicit guidance provided in recommendations regarding how best to implement distress screening (Knobf, Major-Camps, Chagpar, Seigerman, & McCorkle, 2014; Mitchell, 2015). Because the definition of distress is somewhat vague and all-encompassing, screening guidelines do not specify what aspects of distress should be screened, with what measures, and among whom. For instance, the IOM calls for cancer centers to screen broadly for "any of a comprehensive array of psychosocial health problems" (Institute of Medicine, 2008, p. 362). Accreditation guidelines also lack specificity, requiring hospitals to screen generally for distress using a measure of their choice (American College of Surgeons, 2012). As a result, cancer centers across the country vary according to type(s) of constructs assessed and type(s) of measures used in their distress screening programs. Several cancer centers screen with general measures assessing overall distress, whereas others use combinations of tools measuring various sub-constructs of distress, such as depression and anxiety. Implementation of distress screening also varies by hospital according to several system-level factors including who implements distress screening, timing and frequency of screening, whether screening is self- or interviewer-administered, computer versus paper-and-pencil administration, referral and triage processes, and types of available psychosocial services. Further research is needed to identify best practices for distress screening to inform guidelines and procedures in this context nationwide.

## Effectiveness of Distress Screening

Outcomes of distress screening can be conceptualized as proximal, medial, and distal. The proximal outcome of distress screening is the accurate identification of distressed patients, and, relatedly, determination of patients' current level of distress. Medial outcomes include measures of the coordination of care that occurs from assessment of distress to referral to services to receipt of psychosocial intervention. Distal outcomes include measures of patients' psychosocial functioning following engagement in the entire distress screening process including provision of intervention when needed.

**Distal outcomes.** There is mixed evidence regarding whether distress screening leads to improvements in distal outcomes, such as distress or psychosocial functioning post-screening. Mitchell (2013) conducted a review of intervention implementation studies investigating the impact of distress screening on patient-reported psychosocial outcome measures. Of the 24 studies included in this review, 14 were randomized controlled trials, and 10 used non-randomized designs. Of the fourteen randomized controlled trials, seven demonstrated improvement in at least one distal psychosocial outcome (Carlson et al., 2010; Carlson et al., 2012; Klinkhammer-Shalke et al., 2012; Macvean, White, Pratt, Grogan, & Sanson-Fisher, 2007; McLachlan et al., 2001; Sarna, 1998; Velikova et al., 2004). Sarna et al. (1998), in a randomized controlled trial assigning 48 advanced lung cancer patients to a screening only condition versus a condition where the results of screening were provided to nurses, found statistically significant improvement in distress at six months among those individuals in the screening plus feedback versus screening only condition. Velikova et al. (2004) also randomized 286 patients with various types of cancer to a screening only versus screening with results provided to clinicians condition, finding statistically significant improvement in emotional well-being in the screening plus feedback versus screening only condition. Macvean, White, Pratt, Grogan, and Sanson-Fisher (2007) randomly assigned 52 colorectal cancer patients to a screening only condition versus screening plus telephone follow-up by volunteers trained to assist patients in addressing identified needs. Individuals in the screening plus telephone follow-up condition exhibited statistically significant improvement in depression and supportive care needs as compared to the screening only condition. Klinkhammer-Shalke et al. (2012) randomized 200 breast cancer patients to a screening only condition versus a condition consisting of screening plus a profile and report sent to the patient's coordinating practitioner. Klinkhammer-Shalke et al. (2012) found that individuals in the screening plus profile and report condition exhibited statistically significant improvement in quality of life as compared to the screening only condition.

Three of the seven successful randomized controlled trials included in Mitchell's (2013) review only found significant effects of intervention on distal psychosocial outcomes among particular subgroups or only for particular outcomes (Carlson, Groff, Maciejewski, & Bultz, 2010; Carlson et al., 2012; McLachlan et al., 2001). For instance, McLachlan et al. (2010) randomly assigned 450 patients with various types of cancer to screening only versus screening plus provision of a computer-generated summary of screening results to the patient's doctor and coordination nurse; the coordination nurse also created an individualized management plan based on the patient's identified needs. Participants with moderate to severe depression exhibited statistically significant reduction in depressive symptoms six months post-screening in the screening plus feedback and individualized management plan condition versus screening only condition. Two randomized controlled trials conducted by Carlson et al. (2010) and Carlson et al. (2012) found improvement in only some distal outcomes following distress screening. Carlson et al. (2010) randomly assigning 585 lung and breast cancer patients to one of three conditions: 1) minimal screening (i.e., screening with Distress Thermometer only); 2) full screening (i.e., screening with the Distress Thermometer and measures of anxiety and depression, plus filing a summary report of concerns in the patient's chart); and 3) triage (i.e., full screening plus optional phone triage and referral to various resources). Carlson et al. (2010) reported distress scores as well as percentage of patients with distress scores exceeding the clinical cutoff as outcome measures. Carlson et al. (2010) found only a marginally statistically significant main effect of condition on distress scores at three months; however, the study authors found that the percentage of patients with distress scores greater than the cutoff was significantly lower in the triage (36%) versus full screening (46%) and minimal screening (49%) conditions ($p < .01$). Among lung cancer patients, the authors found no effect of condition on scores, but did find the percentage of patients whose distress scores exceeded the cutoff were significantly lower in the triage versus full and minimal screening groups ($p < .01$). Among breast cancer patients, participants in the full screening and triage groups exhibited statistically significant improvements in distress versus the minimal screening group ($p < .05$), but no differences in the proportion of patients with distress scores exceeding the clinical cutoff. Carlson et al. (2012) assigned 2,133 newly diagnosed cancer patients to a computerized triage condition (i.e., patients receiving a printout summarizing how to access services based on their screening; the printout was also attached to the patient's medical chart) and personalized triage condition (i.e., participants received a printout summarizing concerns endorsed on screens and patients were contacted by a member of the screening team within 3 days to discuss referrals; the printout was also attached to the patient's medical chart). No differences in participants' distress, anxiety, depression, pain and fatigue over time were found between the computerized and personalized triage conditions; however, a lower percentage of patients' distress scores in the computerized triage group exceeded the clinical cutoff as compared to the personalized triage group. The remaining seven randomized clinical trials that investigated the impact of distress screening on distal psychosocial outcomes found no impact of intervention on these outcomes (Braeken, Lechner, Houben, van Gils, & Kempen, 2011; Detmar, Muller, Schornagel, Wever, & Aaronson, 2002; Girgis, Breen, Stacey, & Lecathelinais, 2009; Hollingworth et al., 2012; Maunsell, Brisson, Deschines, & Frasure-Smith, 1996; Mills, Murray, Johnston, Cardwell, & Donnelly, 2009; Rosenbloom, Victorson, Hahn, Peterman, & Cella).

Of the remaining 10 non-randomized controlled trials included in this review, Mitchell (2013) reported that only one demonstrated a positive impact of screening on patient-reported psychosocial outcomes (Bramsen et al., 2008). Bramsen et al. (2008) used a sequential cohort design finding that among individuals with cancer of the digestive organs, breast, and head and neck, those in the screening group exhibited significantly greater improvement in mental health functioning compared to individuals in the usual care group.

In contrast to the studies described above exploring distal outcomes of the entire distress screening process (i.e., screening plus intervention), a substantial body of literature exists on the effectiveness of psychosocial interventions in isolation (i.e., not in conjunction with distress screening processes). These findings are promising. If distress screening processes can accurately identify distressed individuals and connect them to services, effective interventions do exist to improve distress. Faller et al. (2013) conducted a systematic review and meta-analysis of 198 randomized controlled trials published prior to 2010 evaluating the impact of non-pharmacologic psychosocial interventions on emotional distress in cancer patients. The review found that individual psychotherapy, group psychotherapy, relaxation training, and psycho-education demonstrated small-to-medium effects on emotional distress, anxiety, depression, and quality of life, respectively. Larger effect sizes were demonstrated for studies with samples comprised of cancer patients experiencing heightened psychosocial distress. The review found no effect of information only interventions on psychosocial outcomes. Faller et al. (2013), however, indicated that these results should be taken with caution due to the low quality of reporting in many trials. Yeh, Chung, Hsu, and Hsu et al. (2014) and Meijer et al. (2013) conducted smaller reviews of randomized controlled trials evaluating the impact of psychosocial intervention on distress in cancer patients. Yeh et al. (2014) identified nineteen randomized controlled trials on this topic published between 2008 and 2013, of which eight reported significant improvements in psychological distress from pre-to-post intervention as compared to a control group. The systematic review conducted by Meijer et al. (2013) explored the effectiveness of psychosocial interventions on distress among cancer patients identified as distressed. Meijer et al. (2013) found pharmacological, psychotherapy, and collaborative care interventions to lead to significant improvements in distress among cancer patients identified as distressed, with small-to-moderate effect sizes.

While the literature evaluating distal outcomes of psychosocial interventions in isolation is promising, the literature on distal outcomes following distress screening is mixed. Given this in conjunction with the fact that the effectiveness of distress screening processes on distal outcomes relies on the effectiveness of distress screening's various components (i.e., assessment, referral, and intervention), it is important to explore the effectiveness of distress screening's components, which can be measured through proximal and medial outcomes.

**Proximal outcomes.** A great deal of literature explores distress screening's impact on its proximal outcome: the ability to accurately identify cancer patients that are clinically distressed and to characterize their levels of distress. Vodermaier, Linden, and Siu (2009) conducted a systematic review evaluating the psychometric properties of assessment instruments used to screen for emotional distress in cancer patients. Thirty-three distress screening measures (nine ultra-short measures containing one to four items, fifteen short measures containing five to twenty items, and nine long measures containing twenty-one to fifty items) were identified in this review. The measures' psychometric properties were evaluated as excellent, good, moderate, fair, or poor according to their reliability, validity, and the quality of the criterion measure against which the instrument was validated. Among the ultra-short distress screening measures only one measure, the combination of two depression questions, “Are you depressed?” and “Have you lost interest?”, exhibited excellent psychometric properties, and one measure, the single item depression question (i.e., “Are you depressed?”), exhibited good psychometric properties. Both the single question “Have you lost interest?” and the Visual Analog Scale received moderate ratings for their psychometric properties. The remaining three short measures included in this review received fair or poor ratings of psychometric properties. Notably, the Distress Thermometer only received a fair rating for its psychometric properties (Roth et al., 1998). The Distress Thermometer is a commonly used distress screening measure promoted in the NCCN guidelines (National Comprehensive Cancer Network, 2017; Roth et al., 1998). The Distress Thermometer contains one question asking the patient to rate his or her level of distress in the past week on a scale from 0 (no distress) to 10 (extreme distress; National Comprehensive Cancer Network, 2017; Roth et al., 1998).

Among short measures, one received a classification of excellent psychometric properties (Center for Epidemiological Studies—Depression Scale); seven received a classification of good psychometric properties (Brief Symptom Inventory – 18, Patient Health Questionnaire – 9, Edinburgh Postnatal Depression Scale, General Health Questionnaire-12, Hospital Anxiety and Depression Scale, Hornheide Questionnaire-9, and PTSD Checklist); and one (Brief Edinburgh Depression Scale-6) received a rating of moderate psychometric properties. The remaining six short measures received a classification of poor psychometric properties (Vodermaier, Linden, & Siu, 2009). Among long measures, two exhibited excellent psychometric properties (Beck Depression Inventory and General Health Questionnaire-28), and three (Psychosocial Screen for Cancer, Rotterdam Symptom Checklist, and Questionnaire on Stress in Cancer Patients Revised-R23) exhibited good psychometric properties. The remaining four long measures received poor psychometric ratings (Vodermaier et al., 2009). It is evident that a wide variety of psychosocial distress screening measures exist of varying psychometric quality, and it is important that cancer centers implementing distress screening use psychometrically strong instruments in order to facilitate improvements in distal outcomes such as distress post-screening.

**Medial Outcomes.** The effectiveness of distress screening on distal outcomes not only relies on the effectiveness of distress screening on its proximal outcome but also on its medial outcomes. Medial outcomes of distress screening include patient-provider communication, receipt of referral, and receipt of psychosocial services.

***Patient-provider communication.*** Distress screening has been evaluated according to its impact on the medial outcome, patient-provider communication. Patient-provider communication is an integral component of distress screening, as connecting patients with appropriate psychosocial resources relies on successful coordination of care between the patient and several providers. Eleven of the twenty-four studies included in Mitchell's (2013) review investigated patient-provider communication in the context of distress screening; of these eleven studies, seven used randomized controlled trials and four used non-randomized designs. Of the seven randomized controlled trials, all compared a screening only condition versus screening plus feedback of screening results to providers and/or patients condition; only four of these seven randomized controlled trials found that those in the screening plus feedback condition exhibited improved patient-provider communication as compared to individuals in the screening only condition (Detmar et al., 2002; Girgis et al., 2009; Sarna, 1998; McLachlan et al., 2001). Of the four studies using non-randomized designs to explore the impact of distress screening on patient-provider communication, only one reported significant improvement in patient-provider communication following screening. Hilarius, Kloeg, Gundy, and Aaronson et al. (2008), using a sequential cohort design, reported significantly more patient-provider interactions related to quality of life in a screening versus usual care condition.

***Receipt of referral.*** Another medial outcome is receipt of referral to psychosocial services. Mitchell's (2013) review investigated the effectiveness of distress screening on referral to psychosocial services. Of the twenty-four studies included in this review, ten investigated the impact of distress screening on referral to psychosocial service (three of which were randomized controlled trials and seven of which used quasi-experimental designs; Braeken et al., 2011; Bramsen et al., 2008; Carlson et al., 2010; Grassi et al., 2011; Girgis et al., 2009; Hilarius, Kloeg, Gundy, & Aaronson et al., 2008; Ito et al., 2011; Pruyn et al., 2004; Shimuzu et al., 2010; Thewes, Butow, Stuart-Harris, & The Greater Southern Area Health Service Screening Collaborative Group, 2009). In a large randomized controlled trial of 2,223 patients with breast or colorectal cancer assigned to one of three groups: screening plus review of results with a telephone case worker, screening plus review of results with an oncologist or general practitioner, and screening alone, Girgis, Breen, Stacey, and Lecathelinais et al. (2009) found that individuals in the screening plus feedback from telephone case worker condition received significantly more referrals to psychosocial services as compared to the screening only and screening plus feedback from oncologist/general practitioner conditions ($p < .001$). Carlson et al. (2010) conducted a randomized controlled trial of 585 lung and breast cancer patients receiving 1) minimal screening (i.e., screening with Distress Thermometer only); 2) full screening (i.e., screening with the Distress Thermometer and measures of anxiety and depression, plus filing a summary report of concerns in the patient's chart); or 3) triage (i.e., full screening plus optional phone triage and referral to various resources). While the authors did not report differences in receipt of referral according to condition, the authors did report that the best predictor of improvement in anxiety and depressive symptoms in the full screening and triage conditions was receipt of psychosocial referral. The third randomized controlled trial included in Mitchell's review that explored the impact of distress screening on receipt of psychosocial referrals did not find distress screening to significantly impact this outcome (Braeken et al., 2011). Five of the seven quasi-experimental studies included in Mitchell's review found that distress screening led to significant increases in rates of referral to psychosocial services in the experimental versus control condition (Bramsen et al., 2008; Grassi et al., 2011; Ito et al., 2011; Pruyn et al., 2004; Shimuzu et al., 2010).

***Receipt of psychosocial services.*** For the medial outcome receipt of psychosocial services (i.e., intervention or care), Mitchell (2013), in his review evaluating the impact of 24 distress screening intervention implementation studies, identified only one study reporting a significant increase in receipt of psychosocial services following distress screening. Specifically, Mitchell described a randomized controlled trial conducted in Canada for which personalized versus computerized screening led to significantly greater access to psychosocial services (20% vs. 15% received psychosocial services; Carlson et al., 2012). Mitchell noted that screening was more effective when it was linked with mandatory referral or intervention, and further speculated that, "aftercare is probably the rate-limiting step" and "the main barrier to successful implementation appears to be receipt of appropriate aftercare" (Mitchell, 2013, p. 222). Additional studies not noted in Mitchell's review have investigated receipt of psychosocial services following distress screening (detailed in the below sections); however, limitations to these studies exist. Further, most studies including this outcome have been conducted outside of the United States which is important given that the U.S. health care system differs greatly from healthcare systems in other countries (Barr, 2016). In the United States, healthcare is both privatized and public. Some citizens' healthcare is financed through private insurers and others' healthcare is financed through public programs, like Medicare and Medicaid. However, some citizens do not have either privately or publicly funded health insurance and, therefore, have limited access to healthcare. In comparison, several other countries have universal healthcare such that all citizens receive a basic level of healthcare coverage. These drastically different healthcare systems lead to remarkable disparities in access and receipt of healthcare (Barr, 2016). Due to these differences, studies conducted in the United States versus studies conducted in other countries exploring receipt of psychosocial services following distress screening will be described in separate sections.

*U.S. studies reporting receipt of psychosocial services.* In the United States, two studies utilizing cohort designs with retrospective medical record review noted receipt of psychosocial service following distress screening (Hammelaf, Friese, Breslin, Riba, & Schneider, 2013; Lo, Ianniello, Sharma, Sarnacki, & Finn, 2016). Lo, Ianniello, Sharma, Sarnacki, and Finn (2016) noted receipt of psychosocial care in pre- and post-distress screening groups, finding that more patients used patient navigation and behavioral health services in the post- versus pre-distress screening groups; no significant differences were found for social work utilization. The authors indicated that after controlling for patient characteristics, post-screening patients had 126% and 63% greater odds of using patient navigation and social work, respectively, as compared to patients in the pre-screening group. Hammelaf, Friese, Breslin, Riba, and Schneider (2013) reported that patients in an enhanced screening vs. historical control group received psychosocial services more quickly following referral (2.7 vs. 5.8 days, respectively, $p < .05$). Hammelaf et al. (2013) also noted that 59% of distressed patients received psychosocial services in the enhanced screening group, but did not report rates of receipt in the historical control group.

Four single-group studies conducted in the United States used retrospective medical record review to report information related to receipt of psychosocial services subsequent to distress screening. In a sample of 644 predominantly non-Hispanic white women diagnosed with cancer and screened with the Edmonton Symptom Assessment System, Funk, Cisneros, Williams, Kendall, and Hamann (2016) described that 99 individuals received initial psychosocial assessments within 14 days by a team member, of which 19 requested and completed at least one follow-up appointment. Among 1190 predominantly white patients with solid organ cancer, Shreders et al. (2016) noted that following screening with the Patient Health Questionnaire-9, individuals with high (i.e., worse) versus low depression scores were more likely to attend psychiatry appointments (45% vs. 12%, $p < .01$); the authors did not note overall rate of receipt of psychosocial services.

One single-group study provided a detailed exploration of factors associated with receipt of psychosocial services following distress screening (Azuero, Allen, Kvale, Azuero, & Parmelee, 2014). Azuero et al. (2014) found that among 149 predominately white, female cancer patients in a palliative care unit, 66 had at least one psychology service visit from 2006 to 2009 (*M* number of visits = 1.74). Azuero et al. (2014) explored associations between patient characteristics and psychology service utilization finding significant positive relationships between service utilization and pancreas/gall bladder/kidney disease comorbidity, total palliative care visits, anxiety, and psychological symptom burden; significant negative relationships between psychology service utilization and age, and utilization and quality of life; and a significant relationship between gender and utilization such that utilizers were more often women than men (all $p$'s $< .05$). The authors also reported that patients who met criteria for moderate or greater anxiety or depression were more likely than individuals with less than moderate anxiety or depression to utilize psychology services (50% vs. 34.5%, respectively; statistical significance testing not reported). Azuero et al. (2014) also conducted logistic regression models examining predictors of psychology service utilization; in examining predisposing factors (gender, age, race, number of palliative care visits) as predictors, the authors found total number of palliative care visits ($p < .001$) and younger age  ($p < .05$) to be significant determinants of psychology service utilization; in examining enabling factors as predictors (multiple palliative providers, medication use) the authors found seeing multiple providers ($p < .01$) and not taking non-opioid analgesics ($p < .05$) to be significant determinants of psychology service utilization; in examining need factors (primary cancer diagnosis, psychological and medical comorbidities, quality of life, pain severity and intensity, and psychological and physical symptoms) as predictors, the authors found that having a diagnosed pancreas, gall bladder, or kidney disease comorbidity ($p < .05$) and higher body mass index ($p < .05$) to be significant determinants of psychology service utilization; in a model incorporating all significant variables from the aforementioned three models, the authors found total number of visits ($p < .001$), seeing multiple providers ($p < .01$), and absence of a non-opioid analgesic ($p < .05$) to be significant determinants of psychology service utilization. Johnson, Gold, and Wyche (2010) found that among 143 women with gynecologic cancer treated with chemotherapy and screened with the Distress Thermometer, 39 received medication and counseling, 17 counseling only, 4 medication only, and 22 assessment but no intervention.

Additional U.S. studies document acceptance of referral (Cimino, Albert, Safier, Harris, & Kinderman, 2016; Johnson, George, & Fader, 2017; O'Hea et al., 2014), referral and receipt as one combined variable (Zebrack et al., 2015), or other consult liaison services (Parker et al., 2016) following distress screening, but do not document receipt of psychosocial care specifically. Overall, only a small number of studies conducted within the United States explore receipt of psychosocial services following distress screening.

Most of these studies used single-group study designs documenting rates of receipt following distress screening. Of the two studies using quasi-experimental designs, one reported that individuals who were screened were more likely to receive psychosocial services as compared to those who were not screened, and the other reported that individuals who were screened received psychosocial services more quickly than those in the usual care group. It is evident that more research utilizing strong study designs is needed to explore receipt of psychosocial services following distress screening.

*Non-U.S. studies reporting receipt of psychosocial services.* Outside of the United States, six studies conducted in Canada, Sweden, Italy, and Japan utilized cohort designs with medical record review and documented receipt of psychosocial care in an intervention (i.e., screening, or enhanced screening that includes screening plus feedback of distress screening results to patients and/or providers) versus usual care condition (Grassi et al., 2011; Ito et al., 2011; Li et al., 2016; Shimuzu et al., 2005, 2010; Thalén-Lindström, Larsson, Glimelius, & Johansson, 2013). In Canada, Li et al. (2016) compared receipt of psychosocial care following screening in 2012 versus 2013 in a comprehensive cancer center. Li et al. (2016) generally noted increased assessment and intervention for emotional distress in 2013 versus 2012. Specifically, the authors noted a statistically significant increase in receipt of intervention for depression (7% to 33%, $p < .01$), but not anxiety, from 2012 to 2013. Within a university hospital in Sweden, Thalén-Lindström et al. (2013) found that following referral, 43% versus 5% of patients attended clinical assessment in the enhanced screening versus usual care group; 24% versus 2% received subsequent psychosocial care (individual cognitive-behavioral therapy or supplementary support services such as group therapy) in the enhanced screening versus usual care group. Grassi et al. (2011) conducted a study in a hospital in Italy finding 12% versus 6.7% of patients in the screening versus usual care cohort received psychosocial services. In Japan, Shimizu et al. (2005) and Shimizu et al. (2010) found that a significantly higher proportion of individuals in the screening versus usual care group received treatment for depression or adjustment disorders (11.5% in the screening group vs. 2.5% in the usual care group in 2005 and 5.3% vs. .3% in 2010, both *p*'s < .01). Ito et al. (2011) also found that among chemotherapy patients screened for distress, time from chemotherapy treatment until first psychiatric service visit was significantly shorter during the enhanced screening period versus usual care (12.9 days vs. 55.6 days, $p < 0.001$).

Further, outside of the United States, three single group studies utilizing retrospective medical record review documented receipt of psychosocial services following distress screening (in Canada, Taiwan, and Germany; Groff, Holroyd-Leduc, White, & Bultz, 2017; Sollner, Maslinger, Konig, Devries, & Lukas, 2004; Wang et al., 2015). In two outpatient oncology clinics in Canada, Groff et al. (2017) reviewed 184 charts of cancer patients, noting that 163 cancer patient charts indicated completion of screening, of which 80% also indicated that a conversation occurred with the patient about their distress; of the 89 charts meeting criteria for psychosocial intervention, 76% received intervention. In a cancer center in Taiwan, Wang et al. (2015) documented that 36% of cancer patients screened and identified as distressed made contact with the psychosocial care team; 20%, 12%, and 4% of cancer patients screened and identified as distressed specifically made contact with social workers, psychiatrists, as well as both psychiatrists and social workers, respectively. In a radiation oncology unit in Austria, Sollner, Maslinger, Konig, Devries, and Lukas (2004) noted that 69% of 58 patients that were screened, identified as distressed, and offered an interview with a social worker or psychotherapist, accepted it; 48 patients screened and identified as distressed received psychosocial counseling, 36 from psychotherapists, 6 from social workers, and 6 from both psychotherapists and social workers. Further, in addition to the one randomized controlled trial [Carlson et al. (2012)] noted in Mitchell's (2013) review, Braeken et al. (2013) also conducted a randomized controlled trial in a radiation oncology unit in the Netherlands reporting that within the first 3 months of the study, a higher proportion of individuals in the distress screening versus usual care condition received psychosocial care (12.7% vs. 9.7%); however, statistical testing of differences between the distress screening and usual care groups was not adequately reported. Furthermore, the study authors reported that during the last nine months of the study period a higher proportion of individuals in the usual care versus distress screening condition received psychosocial care (8% vs. 7.1%).

Additional studies outside of the United States documented receipt of same-day psychosocial assessment, triage, or other consult-liaison services (Bramsen et al., 2008; Carlson et al., 2010; Dolbeault, Boistard, Meuric, Copell, & Bredart, 2011; Hawkes, Hughes, Hutchinson, & Chambers, 2010; Pruyn et al., 2004; McLachlan et al., 2001; Taenzer et al., 2000) or acceptance of referral (Braeken et al., 2011; Bauwens, Baillon, Distelmans, & Theuns, 2014; Curry, Cossich, Matthews, Beresford, & McLachlan, 2014), but did not specify subsequent receipt of psychosocial intervention specifically; or documented self-reported receipt of psychosocial care (i.e., not using medical record review but via retrospective patient self-report; Sharpe et al., 2004; Waller, Williams, Groff, Bultz, & Carlson, 2013). In sum, research conducted outside of the United States on receipt of psychosocial services following distress screening found some evidence for the effectiveness of distress screening to increase receipt of psychosocial services, particularly when distress screening includes a member of the healthcare team contacting the patient to coordinate referrals. However, these findings are based on a limited number of studies most using quasi-experimental designs. Additional research using strong study methodology is needed in this area.

*Limitations of studies reporting receipt of psychosocial services.* Among all studies exploring receipt of psychosocial service, receipt of service is mainly included as a secondary outcome (i.e., not as the main purpose of the study), leading to scant information reported on this outcome. Further, in such studies the screening preceding receipt was conducted using the following instrument(s): Distress Thermometer, Distress and Impact Thermometer, Distress Thermometer and Problems List, Edmonton Symptom Assessment System, Canadian Problem Checklist, Pain Scale, Hospital Anxiety and Depression Scale, Questionnaire to Assess the Need for Psychosocial Support, European Quality Assurance Documentation System for Consultation Liaison Services, Distress Assessment and Response Tool, Dutch Screening inventory of Psychosocial Problems, Patient Health Questionnaire-9, Generalized Anxiety Disorder-7, European Organisation for Research and Treatment of Cancer Core Quality of Life Questionnaire-30, Pain and Fatigue Thermometers, and the Psychological Screen for Cancer (Part C). Most commonly, screening instruments and referral processes were done via paper and pencil instead of using computerized processes, or the study did not mention whether a computerized screening and referral system was used. Findings evaluating receipt of psychosocial services from computerized systems that automate screening and referrals may differ from findings reported in studies where referrals are human-generated.

Additionally, most studies only generally noted receipt of psychosocial care and did not indicate specifics in this regard; this is a major limitation as it is unclear if receipt entailed a single same-day consultation versus long-term therapy or treatment, or if care received was evidence-based. There are a small number of exceptions. A few studies noted type of psychosocial care received following distress screening; however, the types of psychosocial care described still lacked in breadth and specificity. In the United States, Lo et al. (2016) noted whether patients received social work, patient navigation, or behavioral health services following distress screening, and Johnson et al. (2010) noted whether patients received medication and/or counseling. Also, in the United States, Shreders et al. (2016) reported whether a single particular type of psychosocial service, psychiatry, was received. Outside of the United States, Li et al. (2016) and Shimuzu et al. (2010) noted interventions for depression versus anxiety; Wang et al. (2015) noted receipt of care from psychiatrists or social workers; Thalen et al. (2013) noted receipt of cognitive behavioral therapy versus other supplementary support services; and Sollner et al. (2004) specified care provision by social workers versus psychotherapists and noted number of sessions received. Additionally, Carlson et al. (2012) provided detailed information regarding receipt of 15 different types of psychosocial services. All other studies did not provide such detail and instead noted generally whether any type of psychosocial service was received.

Further, few studies including receipt of psychosocial care as an outcome noted time between the date of screening and the date psychosocial services were received. In the United States, only one study noted time to receipt in days. Hammelaf et al. (2013) noted that individuals in an enhanced screening versus historical control group received care in 2.7 versus 5.8 days following referral ($p < .05$). Among studies conducted in non-U.S. countries, time from distress screening until the provision of psychosocial service received was noted infrequently, with a few exceptions. Ito et al. (2011) noted that, among chemotherapy patients screened for distress, time from chemotherapy treatment until first psychiatric service visit was significantly shorter during the enhanced screening condition versus usual care (13 vs. 56 days, $p < .001$). Additionally, Wang et al. (2015) described that following screening, 86% of psychosocial services received provided by social workers occurred during 30 days of screening and that 52% of psychiatry appointments occurred within the first three months following screening, the remaining spread out over the subsequent year.

Predictors or variables associated with receipt of psychosocial care have also been rarely investigated in the literature. In the United States, Shreders et al. (2016) reported that individuals with cancer screened for distress with high versus low depression were more likely to attend psychiatry appointments; however, the authors did not report statistical significance testing for this finding or the type(s) of cancer with which the study participants were diagnosed. Also, in the United States, Azuero et al. (2014) explored associations between psychology service utilization and patient characteristics, such as psychological symptoms, age and gender, and medical comorbidities, among individuals diagnosed with cancer. The authors also conducted logistic regression models examining predisposing, enabling, and need factors as determinants of psychology service utilization following distress screening. The study found the total number of palliative care visits ($p < .001$); younger age ($p < .05$); seeing multiple providers ($p < .01$); not taking non-opioid analgesics ($p < .05$); having a diagnosed pancreas, gall bladder, or kidney disease comorbidity ($p < .05$); and higher body mass index ($p < .05$) to be significant predictors of psychology service utilization. Of note, however, Azuero et al.'s study is limited to patients receiving palliative care and did not describe which cancer(s) they were experiencing. The Azuero et al. study was also not naturalistic as psychosocial services were available to study participants at a set rate of $2 (U.S.). The study conducted by Carlson et al. (2012) was the only study to investigate other variables as they relate to receipt of psychosocial care, as well as to also specify type of psychosocial care received and reference receipt according to various time assessment points; this study, however, was conducted in Canada. In a randomized controlled trial comparing screening with computerized versus personalized triage, Carlson et al. (2012) found during the 12 months post-distress screening, 21.6% of patients received at least one psychosocial service ($M$ = 3.69 services), with most commonly received services being individual counseling, nutrition assistance, resource social work assistance, a resource class, and a breast cancer nutrition class. At 3-, 6-, and 12-month time points following distress screening, a significantly higher proportion of patients in the personalized versus computerized triage group received psychosocial services (21% vs. 15%, $p < .01$ for entire duration of study). In both groups, individuals with high versus low distress and individuals with high versus low depression were more likely to access services from baseline to 3-month follow-up; individuals with high distress, anxiety, and depression compared to individuals with low ratings on these domains at 3 months were more likely to access services between 3- and 6-month follow-up. In the personalized group only, patients with high anxiety and fatigue were more likely than those with low anxiety and fatigue to access services; further, individuals with high versus low depression at 6 months were more likely to access services between 6- and 12-month follow-up.

Overall, the literature on receipt of psychosocial services following distress screening has several limitations. Studies rarely explore receipt of psychosocial services as the focus of the study and lack in reporting detail in that they infrequently describe the type of psychosocial services received, time to receipt, or predictors of receipt. Little is also known regarding the impact of computerized screening and referral systems on receipt of psychosocial care. Also, the majority of the literature referencing receipt of referral has been conducted outside of the United States, in Canada, Sweden, Italy, Japan, Taiwan and Germany, countries with healthcare systems that are very different from that of the United States. The degree to which findings on receipt of psychosocial care from studies conducted outside of the United States can generalize to the U.S. healthcare system is unknown.

## Systems Theory

It is evident from the research literature that receipt of psychosocial services following distress screening is impacted by factors at several levels. Systems theory, specifically, Ferlie & Shortell's (2001) model of the health care delivery system, proposes that the health care system is partitioned into four nested levels: 1) the individual patient, 2) the care team, 3) the organization, and 4) the environment. This model serves as a basis for understanding distress screening, as the implementation and effectiveness of distress screening relies on factors related to the patient (e.g., sociodemographic and medical characteristics), the health care team (e.g., type of providers), the organization (e.g., hospital infrastructure, operating systems, and resources), and the environment (e.g., guidelines and standards issued in the context of distress screening). Further research is needed to identify factors at each of these levels that promote effective distress screening.

## Summary and Aims

Given the limitations to current distress screening research on receipt of psychosocial services, combined with the fact that experts in the field have pointed to this area of research as critical to improving distress screening processes and outcomes (Mitchell, 2013), it is imperative to conduct additional research on this topic.

The current study addressed this important issue by evaluating receipt of psychosocial services following distress screening at a comprehensive cancer center in the southwestern portion of United States. The current study addressed major gaps in the literature on distress screening by: 1) evaluating receipt of psychosocial services following engagement in a computerized distress screening, notification, and triage system; 2) describing the specific type of psychosocial services received following engagement in a computerized distress screening, notification, and triage system; 3) investigating time from distress screening to receipt of psychosocial services; and 4) exploring predictors of receipt of psychosocial services and moderating variables in this context.

This study aimed to answer the following questions, within the context of computerized distress screening: 1) What proportions of patients screened and identified as distressed had automated educational materials and automated notifications for psychosocial providers generated for them?; 2) What proportions of patients screened and identified as distressed received appropriate written referrals for psychosocial providers, appropriate psychosocial contacts, and appropriate psychosocial services?; 3) How long did it take patients screened and identified as distressed to receive appropriate written referrals for psychosocial providers, appropriate psychosocial contacts, and appropriate psychosocial services?; 4) Of patients screened and identified as distressed, who received appropriate psychosocial contacts and appropriate psychosocial services?; and 5) Of patients screened and identified as distressed, who received appropriate psychosocial contacts and appropriate psychosocial services most quickly?

Specifically, the current study investigated the following aims:

**Specific Aim 1.** To quantify the proportions of individuals screened and identified as distressed whose screening generated automated printed educational materials and/or automated notifications for psychosocial providers; as well as to quantify the proportions of individuals screened and identified as distressed who received appropriate written referrals, appropriate psychosocial contacts, and appropriate psychosocial services following distress screening.

**Specific Aim 2.** For individuals screened and identified as distressed, to document time to receipt of appropriate written referrals, time to receipt of appropriate psychosocial contacts, and time to receipt of appropriate psychosocial services following distress screening.

**Specific Aim 3.** For individuals screened and identified as distressed, to characterize the relationship of patient, clinical, and health system factors to outcomes (receipt of appropriate psychosocial contacts, receipt of appropriate psychosocial services, time to receipt of appropriate psychosocial contacts, and time to receipt of appropriate psychosocial services). Aim 3 analyses were used to identify which patient, clinical, and health system factors were included as potential predictors in Aims 4 and 5 (only those patient, clinical, and health system factors identified in Aim 3 as significantly associated with outcomes, were entered as potential predictors in Aims 4 and 5).

**Specific Aim 4a.** For individuals screened and identified as distressed, to identify which patient, clinical, and health system factors predict outcomes (receipt of appropriate psychosocial contacts and receipt of appropriate psychosocial services) following distress screening.

**Specific Aim 4.** For individuals screened and identified as distressed, to explore whether race/ethnicity and highest level of education moderate the relationship between number of automated notifications for psychosocial providers and receipt of appropriate psychosocial services following distress screening.

**Specific Aim 5a.** For individuals screened and identified as distressed, to identify which patient, clinical, and health system factors predict outcomes (time to receipt of appropriate psychosocial contacts and time to receipt of appropriate psychosocial services) following distress screening.

**Specific Aim 5b.** For individuals screened and identified as distressed, to explore whether race/ethnicity and highest level of education moderate the relationship between types of appropriate psychosocial services and time to receipt of appropriate psychosocial services following distress screening.

Introduction, in part is currently being prepared for submission for publication of the material. Ustjanauskas, Amy E.; Malcarne, Vanessa L.; Wells, Kristen J.; Clark, Karen; Obenchain, Richard; Loscalzo, Matthew J.; Roesch, Scott C.; Sadler, Georgia R. The dissertation author was the primary investigator and author of this material.

## Method

A retrospective secondary data analysis of routine clinical and medical record data collected at City of Hope was used to investigate study aims. City of Hope is an NCI-designated comprehensive cancer center located in Duarte, California, providing integrated medical treatment and psychosocial services to cancer patients residing predominantly in Los Angeles, San Bernardino, Riverside and Orange counties in California. Study procedures were collaboratively developed with faculty at San Diego State University and the University of California, San Diego; the Department of Supportive Care Medicine at City of Hope; and psychosocial providers working in each of the psychosocial departments included in this study at City of Hope. All study procedures and materials were approved by the Institutional Review Boards at City of Hope, San Diego State University, and the University of California, San Diego.

Participants in this secondary data analysis included 149 patients with a current diagnosis of cancer screened as a part of routine outpatient care at City of Hope during a one-month period in 2016, who, following routine distress screening, declined participation in a study conducted by City of Hope that required participants to complete materials in addition to routine distress screening. Participants in the invited study were not included in this secondary data analysis because they completed additional screening instruments and underwent triage processes that are not a part of City of Hope's usual approach to distress screening and triage. Further, individuals who did not have a current diagnosis of cancer (i.e., individuals receiving care at City of Hope who had not yet been diagnosed with cancer or whom had a history of cancer but no current diagnosis) were excluded from this study. That is, only those participants with a current cancer diagnosis receiving routine distress screening and triage were included in this secondary data analysis. Given that the data used for this project were collected at City of Hope for routine distress screening procedures, and data analysis examined internal outcomes of City of Hope's routine distress screening, no additional consent was needed from patients in order to use their data for this study. Participants screened as a part of routine care in the following clinics were included in this secondary data analysis: gynecology, breast, head and neck, medical oncology, lung, urology, plastics, and hematology/hematology transplant. All included participants were 18 years of age or older.

## Distress Screening and Triage Process and Documentation

At City of Hope, cancer patients identified as distressed via screening are provided automated printed educational materials and/or are connected to psychosocial providers who offer psychosocial services designed to mitigate distress. Psychosocial providers at City of Hope include: social workers, patient navigators, community resources coordinators, rehabilitation specialists, nutrition specialists, physicians, cancer information nurses, nurses other than cancer information nurses, financial counselors, spiritual care specialists/chaplains, and positive image specialists. Positive image specialists are oncology-trained, licensed cosmetologists providing services designed to minimize the visible side effects of cancer. Examples of the services that positive image specialists provide include wig fittings, prosthesis fittings, and make-up demonstrations.

City of Hope's distress screening process is facilitated by a tool called SupportScreen (Loscalzo et al., 2010). SupportScreen is administered via an automated touch-screen tablet application and is completed by all new cancer patients attending appointments at City of Hope. SupportScreen assesses for distress related to 30 problem domains, including medication and treatment side effects and psychological, logistical, spiritual, family, social, and health care concerns. For each problem domain, the patient is asked, “How much of a problem is this for you?” on a 5-point scale: 1 = “Not a problem,” 2 = “Mild Problem,” 3 = “Moderate Problem,” 4 = “Severe Problem,” 5 = “Very Severe Problem,” with additional responses: “Prefer Not to Answer” and “Do Not Know.” Additionally, for each problem domain endorsed as less than a “Moderate Problem,” the patient is asked, “How can we best work with you on this problem?” with the following response options: “Provide written information,” “Talk with a member of the team,” “Written information and talk with team member,” and “Nothing needed at this time” (Loscalzo et al., 2010).

Patients are identified as distressed and in need of an automated triaging action if they endorse: 1) a problem domain rated as a “Moderate Problem,” “Severe Problem,” or “Very Severe Problem”; 2) a problem domain rated as less than a “Moderate Problem” for which a patient endorses: “Provide written information,” “Talk with a member of the team,” “Written information and talk with team member”; and/or 3) the problem domain, “Thoughts of ending my own life now or in the near future,” as a “Mild Problem,” “Moderate Problem,” “Severe Problem,” or “Very Severe Problem” (Loscalzo et al., 2010).

For patients identified as distressed, subsequent automated triaging action(s) include generation of: 1) automated printed educational materials (handed to the patient immediately after screening); and/or 2) automated notifications for psychosocial providers (social workers, patient navigators, community resources coordinators, rehabilitation specialists, nutrition specialists, physicians, cancer information nurses, nurses other than cancer information nurses, financial counselors, spiritual care specialists/chaplains, and positive image specialists; Loscalzo et al., 2010).

Automated notifications for psychosocial providers are generated in real time by SupportScreen and are in the form of an email and/or page (Loscalzo et al., 2010). Typically, automated notifications are in the form of an email; however, if the suicidality item is endorsed on SupportScreen, an additional automated notification by page is sent to social workers and a same-day meeting is arranged. Automated notifications by email for rehabilitation specialists, nutrition specialists, social workers, physicians, and nurses other than cancer information nurses) include a formal summary report detailing actionable items from SupportScreen for which follow-up is needed. Any concerns related to suicidality are also printed in bold on the top of the summary report. Summary reports are also added to the client's electronic medical record. Automated notifications by email for financial counselors, patient navigators, positive image specialists, cancer information nurses, community resources coordinators, and spiritual care specialists/chaplains do not include the formal summary report but instead indicate actionable items from SupportScreen for which follow-up is needed by the respective psychosocial provider.

Once a participant completes the SupportScreen distress screening tool and automated triaging actions are generated, information regarding patient's responses on SupportScreen, automated triaging actions generated, and limited demographic information (highest level of education, race/ethnicity, preferred language, insurance status, age, gender, type of cancer, and whether or not patient was identified as distressed) are automatically summarized and recorded electronically into the SupportScreen database in Excel format on City of Hope's secured network (Loscalzo et al., 2010).

For psychosocial providers that bill for psychosocial services (i.e., nutrition specialists and rehabilitation specialists), following the automated notification generated by SupportScreen, a psychosocial provider in the department writes a written referral, which is documented in the patient's medical record. Following automated notifications (or following automated notifications and written referrals for nutrition specialists and rehabilitation specialists), patients may receive psychosocial contacts (i.e., psychosocial providers call patients via telephone) and/or psychosocial services (i.e., psychosocial providers meet with patients face-to-face to provide services which may include assessment and/or intervention). Psychosocial providers write notes in the patient's electronic medical record noting psychosocial contacts and psychosocial services provided to patients.

In summary, patients are screened for distress using SupportScreen at first appointment via an automated touch-screen tablet (Loscalzo et al., 2010). Data are automatically processed to identify whether or not patients are distressed and in need of an automated triaging action, per the predetermined thresholds. If a patient is identified as distressed and in need of an automated triaging action, SupportScreen generates: 1) automated printed educational materials (handed to the patient immediately after screening); and/or 2) automated notifications for psychosocial providers (social workers, financial counselors, patient navigators, rehabilitation specialists, positive image specialists, cancer information nurses, community resources coordinators, spiritual care specialists/chaplains, nutrition specialists, physicians, or nurses other than cancer information nurses). For psychosocial providers that bill for services (i.e., nutrition specialists and rehabilitation specialists), following the automated notification, a psychosocial provider in the department writes a written referral, which is documented in the patient's medical record. Following automated notifications (or following automated notifications and written referrals, for nutrition specialists and rehabilitation specialists), patients may receive psychosocial contacts (i.e., psychosocial providers call patients via telephone) and/or psychosocial services (i.e., psychosocial providers meet with patients face-to-face to provide services which may include assessment and/or intervention), which are documented in the patient's medical record.

## Data Retrieval and Variables

Data for this study were retrieved from two sources: 1) the SupportScreen database, which contains routine data collected from City of Hope's distress screening process; and 2) medical record review, through which the researcher documented distress screening outcomes (written referrals, psychosocial contacts, and psychosocial services received by patients). The SupportScreen database was provided to the researcher by a member of City of Hope's research team, with patients labeled only by participant identification numbers that were created by City of Hope specifically for this study. A member of the City of Hope research team maintained a master list containing participant identification numbers, corresponding medical record numbers, and dates of screening so that the researcher could link data from the SupportScreen database to data retrieved from medical records.

**Patient and clinical factor variables.** Patient and clinical factor variables included in this study are defined in Table 1 (Part A): highest level of education, race/ethnicity, preferred language, insurance status, age, gender, and type of cancer. The SupportScreen database provided to the researcher contained these patient and clinical factor variables. For any missing data for these variables in the SupportScreen database, the information was extracted from medical records.

**Health system factor variables.** Health system factor variables included in this study are listed and defined in Table 1 (Part B): generation of any type of automated triaging action, type of automated triaging action, types of automated notifications, number of automated notifications, and generation of at least one automated notification. The SupportScreen database provided to the researcher contained these health system factor variables. No data were missing for these variables.

**Outcome variables.** Table 1 (Part C) defines outcome variables, calculated for each type of automated notification generated for a given patient: receipt of appropriate written referral, time to receipt of appropriate written referral, receipt of appropriate psychosocial contact, time to receipt of appropriate psychosocial contact, receipt of appropriate psychosocial service, time to receipt of appropriate psychosocial service, and determination of whether or not follow-up needed and description of follow-up actions. Receipt of appropriate written referral was defined as receiving within 30 days post-screening a written referral that was the same type as the automated notification (e.g., if automated notification generated for nutrition specialists, the appropriate written referral was for nutrition specialists). Receipt of appropriate psychosocial contact was defined as receiving within 30 days post-screening a psychosocial contact that was the same type as the automated notification (e.g., if automated notification generated for nutrition specialists, the appropriate psychosocial contact was for nutrition specialists). Receipt of appropriate psychosocial service was defined as receiving within 30 days post-screening a psychosocial service that was the same type as the automated notification (e.g., if automated notification generated for nutrition specialists, the appropriate psychosocial service was for nutrition specialists). Thirty days was chosen as City of Hope indicated that this was considered their standard of care for the timeframe in which psychosocial services should be received following screening. The variable, determination of whether or not follow-up was needed and description of follow-up actions, was created for any psychosocial provider types who had a systematic process to determine whether or not follow-up (i.e., appropriate written referral, appropriate psychosocial contact, and/or appropriate psychosocial service) was needed for a given automated notification (that was different from the common practice at City of Hope that individuals who are screened and identified as distressed, and whose SupportScreen generated an automated notification for a psychosocial provider, should receive follow-up from that psychosocial provider. All psychosocial provider types followed this common practice, with the exception of social workers who had their own systematic process to determine whether or not a given automated notification for social workers needed follow-up (which is detailed in the Results section).

A researcher used a standardized medical record abstraction form (see Figure 1) to abstract data on distress screening outcomes from patient medical records. For each patient, the researcher would consult the SupportScreen database, and then note on the medical record abstraction form whether or not an automated notification was made for each type of psychosocial provider. Then, for each type of psychosocial provider for which an automated notification was generated, the researcher would consult the master list, which documented date of screening, and then review each patient's medical records within 30 days post-screening. On the medical record abstraction form, the researcher documented for each type of automated notification whether or not, within 30 days post-screening, the patient received the appropriate written referral, appropriate psychosocial contact, and appropriate psychosocial service, respectively. Additionally, for each type of automated notification, the researcher documented on the medical record abstraction form time (in days) to receipt of first appropriate written referral, first appropriate psychosocial contact, and first appropriate psychosocial service, respectively, following distress screening. Further, on the medical record abstraction form, the researcher recorded for automated notifications for social workers the determination of whether or not follow-up was needed and description of follow-up actions. For all psychosocial providers (with the exception of spiritual care specialists/chaplains), data for receipt of and time to appropriate psychosocial contacts and services were abstracted from patients' progress notes in their AllScripts electronic medical record; data for receipt of and time to appropriate written referrals were abstracted from patients' orders in their AllScripts electronic medical record. Spiritual care specialists/chaplains did not record receipt of and time to appropriate psychosocial contacts and services in AllScripts, but instead recorded this information in written records that they maintained. The researcher reviewed these written records for data on receipt of and time to appropriate psychosocial contacts and services for spiritual care specialists/chaplains.

Table 1 (Part D) defines outcome and other summary variables (summary variables refer to the fact that for a given patient these variables are not calculated for each type of automated notification generated, but for all automated notification types combined): number of automated notifications that needed follow-up, generation of at least one automated notification that needed follow-up, receipt of at least one appropriate psychosocial contact, receipt of at least the majority of appropriate psychosocial contacts, receipt of all appropriate psychosocial contacts, time to receipt of first appropriate psychosocial contact, type of first appropriate psychosocial contact, receipt of at least one appropriate psychosocial service, receipt of at least the majority of appropriate psychosocial services, receipt of all appropriate psychosocial services, time to receipt of first appropriate psychosocial service, and type of first appropriate psychosocial service. Outcome and other summary variables were recorded for each participant on section 2 of the medical record abstraction form (see Figure 1).

All data from SupportScreen database and medical record abstraction forms were entered into a combined database in SPSS version 25.0. Following data entry, the researcher reviewed all entered data to ensure that all data were entered correctly. The researcher also checked for any out-of-range, missing, or nonsensical data to ensure accuracy of the data.

## Data Analyses

Descriptive statistics summarizing participant characteristics for the study sample were computed using SPSS version 25.0. Specific analyses are presented for each of the five study aims. Statistical assumptions were evaluated for each respective statistical test.

**Analyses for Specific Aim 1.** Specific Aim 1 was to quantify the proportions of individuals screened and identified as distressed whose screening generated automated printed educational materials and/or automated notifications for psychosocial providers; as well as to quantify the proportions of individuals screened and identified as distressed who received appropriate written referrals, appropriate psychosocial contacts, and appropriate psychosocial services following distress screening. The proportions of individuals screened and identified as distressed whose SupportScreen results generated any type of automated triaging action (i.e., automated printed educational materials and/or an automated notification for a psychosocial provider) versus no automated triaging action were calculated. Then, of those individuals whose SupportScreen results generated any type of automated triaging action, the proportions of individuals whose SupportScreen results generated automated printed educational materials only, automated printed educational materials plus an automated notification for a psychosocial provider, or an automated notification for a psychosocial provider only were calculated. Further, of those individuals screened and identified as distressed, the proportions of individuals whose SupportScreen results generated specific types of automated notifications (i.e., for social workers, financial counselors, patient navigators, rehabilitation specialists, positive image specialists, cancer information nurses, community resources coordinators, spiritual care specialists/chaplains, nutrition specialists, and physicians/nurses other than cancer information nurses) were calculated.

For individuals screened, identified as distressed, and whose SupportScreen generated an automated notification for rehabilitation specialists, the proportion of individuals receiving appropriate written referrals for rehabilitation specialists was calculated. For individuals screened, identified as distressed, and whose SupportScreen generated an automated notification for nutrition specialists, the proportion of individuals receiving appropriate written referrals for nutrition specialists was calculated.

For individuals screened, identified as distressed, and whose SupportScreen generated at least one automated notification that needed follow-up, the following proportions were calculated: 1) the proportion of individuals receiving at least one appropriate psychosocial contact; 2) the proportion of individuals receiving at least one appropriate psychosocial service; 3) the proportion of individuals receiving at least the majority of appropriate psychosocial contacts; 4) the proportion of individuals receiving at least the majority of appropriate psychosocial services; 5) the proportion of individuals receiving all appropriate psychosocial contacts; and 6) the proportion of individuals receiving all appropriate psychosocial services.

**Analyses for Specific Aim 2.** Specific Aim 2 was to document for individuals screened and identified as distressed, time to receipt of appropriate written referrals, time to receipt of appropriate psychosocial contacts, and time to receipt of appropriate psychosocial services following distress screening. For individuals screened, identified as distressed, and who received an appropriate written referral for rehabilitation specialists, mean time to receipt of appropriate written referral for rehabilitation specialists was calculated. For individuals screened, identified as distressed, and who received an appropriate written referral for nutrition specialists, mean time to receipt of appropriate written referral for nutrition specialists was calculated. For individuals screened, identified as distressed, and who received at least one appropriate psychosocial contact, for each type of automated notification generated, mean time to receipt of appropriate psychosocial contact was calculated. For individuals screened, identified as distressed, and who received at least one appropriate psychosocial service, for each type of automated notification generated, mean time to receipt of appropriate psychosocial service was calculated. Additionally, for individuals screened, identified as distressed, and who received at least one appropriate psychosocial contact, mean time to receipt of first appropriate psychosocial contact was calculated. Further, for individuals screened, identified as distressed, and who received at least one appropriate psychosocial service, mean time to receipt of first appropriate psychosocial service was calculated.

**Analyses for Specific Aim 3.** Specific Aim 3 was to characterize for individuals screened and identified as distressed, the relationship of patient, clinical, and health system factors to outcomes (receipt of appropriate psychosocial contacts, receipt of appropriate psychosocial services, time to receipt of appropriate psychosocial contacts, and time to receipt of appropriate psychosocial services). Aim 3 analyses were used to identify which patient, clinical, and health system factors should be included as potential predictors in Aims 4 and 5 (only those patient, clinical, and health system factors identified in Aim 3 as statistically significantly associated with outcomes, were entered as potential predictors in Aims 4 and 5).

Specifically, among individuals screened, identified as distressed, and whose SupportScreen generated at least one automated notification that needed follow-up, analyses were conducted to characterize the relationship between patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, number of automated notifications that needed follow-up) and dichotomous outcome variables (receipt of at least one appropriate psychosocial contact, receipt of at least one appropriate psychosocial service, receipt of at least the majority of appropriate psychosocial contacts, receipt of at least the majority of appropriate psychosocial services). Point-biserial correlations were conducted between continuous factors (age, number of automated notifications that needed follow-up) and dichotomous outcome variables. Chi-square tests were conducted to explore the relationship between dichotomous and categorical factors (gender, preferred language, race/ethnicity, highest level of education, insurance status, type of cancer) and dichotomous outcome variables. Significance testing was conducted with alpha set to .05.

Among individuals screened, identified as distressed, and who received at least one appropriate psychosocial contact, analyses were conducted to characterize the relationship between patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, number of automated notifications that needed follow-up, type of first appropriate psychosocial contact) and the continuous outcome variable (time to receipt of first appropriate psychosocial contact). Further, among individuals screened, identified as distressed, and who received at least one appropriate psychosocial service, analyses were conducted to characterize the relationship between patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, number of automated notifications that needed follow-up, type of first appropriate psychosocial service, time to receipt of first appropriate psychosocial contact) and the continuous outcome variable (time to receipt of first appropriate psychosocial service). Pearson correlations were calculated between continuous factors (age, number of automated notifications that needed follow-up, time to receipt of first appropriate psychosocial contact) and continuous outcome variables. Point-biserial correlations were conducted between dichotomous factors (race/ethnicity, highest level of education, gender, preferred language) and continuous outcome variables. Analysis of variance tests were used to explore differences in continuous outcome variables by categorical patient, clinical, and health system factors (insurance status, type of cancer, type of first appropriate psychosocial contact, type of first appropriate psychosocial service). Significance testing was conducted with alpha set to .05.

**Analyses for Specific Aims 4a and 4b.** Specific Aim 4a was to identify for individuals screened and identified as distressed, which patient, clinical, and health system factors predict outcomes (receipt of appropriate psychosocial contacts and receipt of appropriate psychosocial services) following distress screening**.** Specific Aim 4b was to explore for individuals screened and identified as distressed, whether race/ethnicity and highest level of education moderate the relationship between number of automated notifications for psychosocial providers and receipt of appropriate psychosocial services following distress screening. Four multiple logistic regression models and four logistic regression models were used to explore these aims. Regression analyses were conducted among the subsample of individuals screened, identified as distressed, and whose SupportScreen generated at least one automated notification that needed follow-up.

For model 1, multiple logistic regression was used to identify patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, and/or number of automated notifications) that predict receipt of at least one appropriate psychosocial contact following distress screening. Only those patient, clinical, and health system factors identified as potential predictors in Aim 3 were entered in this model. Potential predictors were entered simultaneously into the regression model.

For model 2, multiple logistic regression was used to identify patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, and/or number of automated notifications) that predict receipt of at least one appropriate psychosocial service following distress screening. Only those patient, clinical, and health system factors identified as potential predictors in Aim 3 were entered in this model. Potential predictors were entered simultaneously into the regression model.

For model 3, logistic regression was used to test whether race/ethnicity moderates the relationship between number of automated notifications and receipt of at least one appropriate psychosocial service. Number of automated notifications and race/ethnicity were entered simultaneously into the regression model.

For model 4, logistic regression was used to test whether highest level of education moderates the relationship between number of automated notifications and receipt of at least one appropriate psychosocial service. Number of automated notifications and highest level of education were entered simultaneously into the regression model.

For model 5, multiple logistic regression was used to identify patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, and/or number of automated notifications) that predict receipt of at least the majority of appropriate psychosocial contacts following distress screening. Only those patient, clinical, and health system factors identified as potential predictors in Aim 3 were entered in this model. Potential predictors were entered simultaneously into the regression model.

For model 6, multiple logistic regression was used to identify patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, and/or number of automated notifications) that predict receipt of at least the majority of appropriate psychosocial services following distress screening. Only those patient, clinical, and health system factors identified as potential predictors in Aim 3 were entered in this model. Potential predictors were entered simultaneously into the regression model.

For model 7, logistic regression was used to test whether race/ethnicity moderates the relationship between number of automated notifications and receipt of at least the majority of appropriate psychosocial services. Number of automated notifications and race/ethnicity were entered simultaneously into the regression model.

For model 8, logistic regression was used to test whether highest level of education moderates the relationship between number of automated notifications and receipt of at least the majority of appropriate psychosocial services. Number of automated notifications and highest level of education were entered simultaneously into the regression model.

For moderation analyses in models 3, 4, 7, and 8, it was hypothesized that race/ethnicity and highest level of education would moderate the relationship between number of automated notifications and receipt of appropriate psychosocial services, such that the relationship would be strongest (i.e., higher number of automated notifications would be associated with greater likelihood of receipt of appropriate psychosocial services) among those individuals not from medically-underserved racial/ethnic groups and with higher levels of education versus individuals from medically underserved racial/ethnic groups and with lower levels of education.

**Analyses for Specific Aims 5a and 5b.** Specific Aim 5a was to identify for individuals screened and identified as distressed, which patient, clinical, and health system factors predict outcomes (time to receipt of appropriate psychosocial contacts and time to receipt of appropriate psychosocial services) following distress screening. Specific Aim 5b was to explore for individuals screened and identified as distressed, whether race/ethnicity and highest level of education moderate the relationship between types of appropriate psychosocial services and time to receipt of appropriate psychosocial services following distress screening. Two multiple Cox regression models and two Cox regression models were used to explore these aims. A censor point of 31 days was used in each multiple Cox regression model and Cox regression model.

Model 9 used multiple Cox regression to identify patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, number of automated notifications that needed follow-up, and/or type of first appropriate psychosocial contact) that predict time to receipt of first appropriate psychosocial contact following distress screening. Only those patient, clinical, and health system factors identified as potential predictors in Aim 3 were entered in this model. Model 9 analyses were conducted using the subsample of individuals who were screened, identified as distressed, and who received at least one appropriate psychosocial contact.

Model 10 used multiple Cox regression to identify patient, clinical, and health system factors (age, gender, race/ethnicity, highest level of education, preferred language, insurance status, type of cancer, number of automated notifications that needed follow-up, type of first appropriate psychosocial service, and time to receipt of first appropriate psychosocial contact) that predict time to receipt of first appropriate psychosocial service following distress screening. Only those patient, clinical, and health system factors identified as potential predictors in Aim 3 were entered in this model. Model 10 analyses were conducted using the subsample of individuals who were screened, identified as distressed, and who received at least one appropriate psychosocial service.

Model 11 used Cox regression to test whether race/ethnicity moderates the relationship between type of first appropriate psychosocial service and time to receipt of first appropriate psychosocial service. Model 11 analyses were conducted using the subsample of individuals who were screened, identified as distressed, and who received at least one appropriate psychosocial service.

Model 12 used Cox regression to test whether highest level of education moderates the relationship between type of first appropriate psychosocial service and time to receipt of first appropriate psychosocial service. Model 12 analyses were conducted using the subsample of individuals who were screened, identified as distressed, and who received at least one appropriate psychosocial service. For moderation analyses in models 11 and 12, it was hypothesized that the relationship between type of first appropriate psychosocial service and time to receipt of first appropriate psychosocial service would vary according to race/ethnicity and highest level of education such that automated notifications for psychosocial providers that do not bill for services versus those who do bill for services would be associated with fewer days to receipt of first appropriate psychosocial service, but only among individuals not from medically-underserved racial/ethnic groups and with higher levels of education.

Method, in part is currently being prepared for submission for publication of the material. Ustjanauskas, Amy E.; Malcarne, Vanessa L.; Wells, Kristen J.; Clark, Karen; Obenchain, Richard; Loscalzo, Matthew J.; Roesch, Scott C.; Sadler, Georgia R. The dissertation author was the primary investigator and author of this material.

# Results

A total of 212 patients completed SupportScreen and declined to participate in a different study conducted at City of Hope that required participants to complete materials in addition to routine distress screening. Of these 212 patients, 63 (29.72%) were excluded from the current study: 60 patients who completed SupportScreen were not currently diagnosed with cancer; one patient was excluded because their medical record number did not exist (and therefore researchers could not review their medical record data); one patient was excluded because their medical record was incomplete (i.e., portions of time were unable to be viewed in medical record); and one additional patient was excluded because while the SupportScreen database indicated they were screened, there was no record of a distress screening in their medical record. Thus, the final analytic sample was 149 participants.

Participant characteristics (*N* = 149) are summarized in Table 2. Participants ranged in age from 23 to 89 (*M* = 61.30) years. The majority of the sample was female (57.05%), English-speaking (89.26%), not from a medically underserved racial/ethnic group (73.15%), and had any college education or more (73.83%). Nearly one-half of the sample had private insurance (49.66%). Patients were most commonly diagnosed with breast cancer (43.62%), followed by cancer of the male genital system (30.20%), urinary system (8.72%), and female genital system (7.38%).

## Specific Aims 1 and 2

Specific Aim 1 was to quantify the proportions of individuals screened and identified as distressed whose SupportScreen generated automated printed educational materials and/or automated notifications for psychosocial providers; as well as to quantify the proportions of individuals screened, identified as distressed, and whose SupportScreen generated at least one automated notification that needed follow-up, who received appropriate written referrals for psychosocial providers, appropriate psychosocial contacts, and appropriate psychosocial services. Specific Aim 2 was to document: for individuals screened, identified as distressed, and who received at least one appropriate written referral, the time to receipt of appropriate written referrals; for individuals screened, identified as distressed, and who received at least one appropriate psychosocial contact, the time to receipt of appropriate psychosocial contacts; and for individuals screened, identified as distressed, and who received at least one appropriate psychosocial service, the time to receipt of appropriate psychosocial services. Of the 149 participants included in this study, 146 (97.99%) were identified as distressed. Table 3 summarizes the types of automated triaging actions generated by SupportScreen for these 146 distressed patients. For all 146 distressed patients (100.00%), SupportScreen generated both automated printed educational materials and at least one automated notification for a psychosocial provider. All 146 distressed patients’ SupportScreens generated an automated notification for social workers and physicians/nurses other than cancer information nurses. SupportScreen also generated automated notifications for financial counselors ($n$ = 47), patient navigators ($n$ = 43), positive image specialists ($n$ = 34), cancer information nurses ($n$ = 33), rehabilitation specialists ($n$ = 31), community resources coordinators ($n$ = 26), spiritual care specialists/chaplains ($n$ = 11), and nutrition specialists ($n$ = 6).

Figure 2 graphically depicts, for individuals screened and identified as distressed, the automated triaging actions generated, as well outcomes of distress screening (determinations of whether or not follow-up needed, receipt of appropriate written referrals, receipt of appropriate psychosocial contacts, and receipt of appropriate psychosocial services) for each type of automated notification generated. Social workers were the only type of psychosocial providers who did not follow the common practice at City of Hope that individuals who are screened and identified as distressed, and whose SupportScreen generated an automated notification for a psychosocial provider, should receive follow-up from that psychosocial provider. Instead, social workers engaged in a systematic process whereby they determined whether or not follow-up was needed for each automated notification generated for social workers. This determination was made based on patient responses on SupportScreen. Social workers reviewed patients' SupportScreen responses for all patients with an automated notification generated for social work. Social workers made the determination that follow-up was not needed: 1) if patients only endorsed the advanced directive item on SupportScreen and asked to not be contacted, or 2) if patients only rated problem domains pertaining to social workers as a "Moderate Problem" or lower on SupportScreen (whereby these individuals immediately received printed contact information for social workers to use at their own discretion). Of the 146 distressed patients receiving an automated notification for social work, 92 were identified by social work as needing follow-up from social work. The remaining 54 patients either only endorsed the advanced directive item on SupportScreen and asked to not be contacted ($n = 36$) or only rated problem items as a "Moderate Problem" or lower on SupportScreen and immediately received printed contact information for social workers to use at their own discretion (*n* = 18). Of the 92 patients identified by social workers as needing follow-up, 57.61% (*n* = 53) received an appropriate psychosocial contact from social workers (*M* = 9.08 days from screening to receipt of appropriate psychosocial contact) and 7.61% (*n* = 7) received an appropriate psychosocial service from social workers (*M* = 2.00 days from screening to receipt of appropriate psychosocial service). Of the 47 patients with automated notifications generated for financial counselors, 8.51% (*n* = 4) received appropriate psychosocial contacts (*M* = 10.75 days from screening to receipt of appropriate psychosocial contact) and 8.51% (*n* = 4) received appropriate psychosocial services from financial counselors (*M* = 10.00 days from screening to receipt of appropriate psychosocial service). Of the 31 patients receiving automated notifications for rehabilitation specialists, 6.45% received written referrals for rehabilitation specialists (*n* = 2; *M* = 11.00 days from screening to receipt of appropriate written referral), 0% received appropriate psychosocial contacts, and 3.23% received appropriate psychosocial services (*n* = 1; *M* = 6.00 days from screening to receipt of appropriate psychosocial service). Of the 26 patients whose SupportScreen generated an automated notification for community resources coordinators, 61.54% (*n* = 16) received appropriate psychosocial contacts (*M* = 3.56 days from screening to receipt of appropriate psychosocial contact) and 0% received appropriate psychosocial services from community resources coordinators. Of the 11 patients with automated notifications for spiritual care specialists/chaplains, no patients received appropriate psychosocial contacts and no patients received appropriate psychosocial services from spiritual care specialists/chaplains. Similarly, of the six patients with automated notifications generated for nutrition specialists, none received appropriate written referrals, appropriate psychosocial contacts, or appropriate psychosocial services from nutrition specialists.

Of note, upon data abstraction, researchers learned that distress screening outcome data were not available for patient navigators, positive image specialists, cancer information nurses, and physicians/nurses other than cancer information nurses. Patient navigators, positive image specialists, and cancer information nurses did not maintain records for individual patients for distress screening outcomes for the time period of interest. When it came to physicians/nurses other than cancer information nurses, given that all patients were screened prior to routine medical care that is provided by physicians/nurses other than cancer information nurses, all participants would have been shown to receive care by these providers and it would have been impossible to determine whether patients received care related to their distress screening. As a result, data for physicians/nurses other than cancer information nurses, patient navigators, positive image specialists, and cancer information nurses were excluded from subsequent analyses summarizing distress screening outcomes.

Figure 3 graphically depicts automated triaging actions generated for distressed patients and distress screening outcomes for all automated notifications combined. Of the 146 patients screened and identified as distressed, 103 patients' SupportScreen generated at least one automated notification that needed follow-up (i.e., 43 patients had automated notifications for social workers only, for which social workers determined no follow-up was needed). For these 103 patients, Table 4 summarizes the total number of automated notifications that needed follow-up generated for each patient. The total number of automated notifications that needed follow-up ranged from one to five ($M = 2.08$; $SD = 1.10$). SupportScreens for 40 of the 103 patients (38.83%) generated only one automated notification that needed follow-up, 31 patients' SupportScreens (30.10%) generated a total of two automated notifications that needed follow-up, 20 patients' SupportScreens (19.42%) generated a total of three automated notifications that needed follow-up, 9 patients' SupportScreens (8.74%) generated a total of four automated notifications that needed follow-up, and 3 patients' SupportScreens (2.91%) generated a total of five notifications that needed follow-up.

For the 103 patients screened and identified as distressed whose SupportScreen generated at least one automated notification that needed follow-up, Table 5 summarizes the proportions of individuals who received appropriate psychosocial contacts and appropriate psychosocial services, for all automated notifications combined. Of these 103 patients, 63 (61.17%) received at least one appropriate psychosocial contact. Only 11 of the 103 patients (10.68%) received at least one appropriate psychosocial service. Additionally, of these 103 patients, 46 (44.66%) received at least the majority of appropriate psychosocial contacts. Only 5 of the 103 patients (4.85%) received at least the majority of appropriate psychosocial services. Further, 18 of the 103 patients (17.48%) received all appropriate psychosocial contacts. Notably, of the 18 patients receiving all appropriate psychosocial contacts, 17 patients' SupportScreen only generated 1 automated notification that needed follow-up and 1 patients' SupportScreen generated 2 automated notifications that needed follow-up. Further, only 3 of the 103 patients received all appropriate psychosocial services.

Table 6 displays time to receipt of appropriate psychosocial contacts and services, calculated for all automated notifications combined. Mean time to first appropriate psychosocial contact was 8.19 days. Mean time to first appropriate psychosocial service was 4.82 days.

**Specific Aim 3**

Specific Aim 3 was to characterize, for individuals screened, identified as distressed, and whose SupportScreen generated at least one automated notification that needed follow-up, the relationship of patient, clinical, and health system factors to outcomes (receipt of at least one appropriate psychosocial contact, receipt of at least the majority of appropriate psychosocial contacts, receipt of at least one appropriate psychosocial service, receipt of at least the majority of appropriate psychosocial services, time to receipt of first appropriate psychosocial contact, and time to receipt of first appropriate psychosocial service). Aim 3 analyses were used to identify which patient, clinical, and health system factors will be included as potential predictors in Aims 4 and 5 (only those patient, clinical, and health system factors identified in Aim 3 as significantly associated with outcomes, were entered as potential predictors in Aims 4 and 5). All continuous variables used in subsequent analyses (Aims 3 through 5) were approximately normally distributed (skewness statistics range: -0.22 to 0.85; kurtosis statistics range: -0.43 to 0.67), with the exception of time to receipt of first appropriate psychosocial service. A square root transformation was used for this variable, resulting in a normally distributed variable with skew and kurtosis statistics of 1.17 and .11 respectively. This square root transformed variable was used in all subsequent analyses (Aims 3 through 5).

Point-biserial correlations between continuous patient, clinical, and health system factors (age, number of automated notifications that needed follow-up) and dichotomous outcome variables (receipt of at least one appropriate psychosocial contact, receipt of at least one appropriate psychosocial service, receipt of at least the majority of appropriate psychosocial contacts, receipt of at least the majority of appropriate psychosocial services) are presented in Table 7a. There was a statistically significant positive moderate correlation between number of automated notifications that needed follow-up and receipt of at least one appropriate psychosocial contact ($r_{pb} = .31$, $p = .002$). Additionally, there was a statistically significant positive weak correlation between number of automated notifications that needed follow-up and receipt of at least one appropriate psychosocial service ($r_{pb} = .24$, $p = .016$). All other correlations between continuous patient, clinical, and health system factors and dichotomous outcome variables were not statistically significant (all $p$'s > .05).

Results of chi-square tests conducted to explore the relationship between dichotomous and categorical patient and clinical factors (gender, preferred language, race/ethnicity, highest level of education, insurance status, type of cancer) and dichotomous outcome variables (receipt of at least one appropriate psychosocial contact, receipt of at least one appropriate psychosocial service, receipt of at least the majority of appropriate psychosocial contacts, receipt of at least the majority of appropriate psychosocial services) are presented in Table 7b. A statistically significant association was found between insurance status and receipt of at least one appropriate psychosocial service ($\chi^2(3, N = 103) = 8.70, p = .034$). All other associations between dichotomous and categorical patient and clinical factors and dichotomous outcome variables were not statistically significant (all *p*'s > .05).

Pearson correlations between continuous patient, clinical, and health system factors (age, number of automated notifications that needed follow-up, time to receipt of first appropriate psychosocial contact) and the continuous outcome variables (time to receipt of first appropriate psychosocial contact, time to receipt of first appropriate psychosocial service) are presented in Table 7c. There was a statistically significant negative weak correlation between number of automated notifications that needed follow-up and time to receipt of first appropriate psychosocial contact ($r = -.29, p = .020$). There also was a statistically significant positive strong correlation between time to receipt of first appropriate psychosocial contact and time to receipt of first appropriate psychosocial service ($r = .77, p = .044$). All other correlations between continuous patient, clinical, and health system factors and continuous outcome variables were not significant (all *p*'s > .05).

Point-biserial correlations between dichotomous patient and clinical factors (race/ethnicity, highest level of education, gender, preferred language) and the continuous outcome variables (time to receipt of first appropriate psychosocial contact, time to receipt of first appropriate psychosocial service) are presented in Table 7d. There was a statistically significant negative strong correlation between preferred language and time to receipt of first appropriate psychosocial service ($r_{pb} = -.69, p = .018$), such that English language (versus other than English language) was associated with shorter time to receipt of first appropriate psychosocial service. All other correlations between dichotomous patient and clinical factors and continuous outcome variables were not statistically significant (all *p*'s > .05).

Results of analyses of variance tests to explore differences in continuous outcome variables (time to receipt of first appropriate psychosocial contact, time to receipt of first appropriate psychosocial service), by categorical patient, clinical, and health system factors (insurance status, type of cancer, type of first appropriate psychosocial contact, type of first appropriate psychosocial service) are presented in Table 7e. Levene's test was conducted to evaluate equality of variances assumption for all analysis of variance tests. Variances of populations were equal for all but three analysis of variance tests: 1) the test exploring whether time to receipt of first appropriate psychosocial contact varied according to type of first appropriate psychosocial contact (Welch's test was reported instead for this test); 2) the test exploring whether time to receipt of first appropriate psychosocial service varied according to insurance status (Levene's and Welch's tests were unable to be performed due to small sample size, and therefore the regular analysis of variance test was reported using a more conservative significance level of alpha < .01); and 3) the test exploring whether time to receipt of first appropriate psychosocial service varied according to type of first appropriate psychosocial service (Welch's test was unable to be performed due to small sample size, and resultantly, the regular analysis of variance test was reported using a more conservative significance level of alpha < .01). Only one analysis of variance test was statistically significant. There was a statistically significant difference in time to receipt of first appropriate psychosocial contact according to type of first appropriate psychosocial contact ($F(2,5) = 15.93$, $p = .006$). Specifically, time to receipt of first appropriate psychosocial contact was significantly shorter for community resource coordinators (as compared to both social workers and financial counselors). All other analysis of variances tests were not statistically significant (all *p*'s > .05).

### Specific Aim 4

Specific Aim 4a was to identify, for individuals screened, identified as distressed, and whose SupportScreen generated at least one automated notification that needed follow-up, which patient, clinical, and health system factors predict outcomes (receipt of at least one appropriate psychosocial contact, receipt of at least the majority of appropriate psychosocial contacts, receipt of at least one appropriate psychosocial service, receipt of at least the majority of appropriate psychosocial services). Specific Aim 4b was to explore, for individuals screened, identified as distressed, and whose SupportScreen generated at least one automated notification that needed follow-up, whether race/ethnicity and highest level of education moderate the relationship between number of automated notifications for psychosocial providers and outcomes (receipt of at least one appropriate psychosocial service and receipt of at least the majority of appropriate psychosocial services). Due to small and unequal sub-group sample sizes, planned models for regression analyses predicting or exploring moderators in the context of receipt of at least one appropriate psychosocial service and receipt of at least the majority of appropriate psychosocial services are not reported here (i.e., Models 2, 3, 4, 6, 7, 8; these results are included in a supplement that is available by request from the author). Model 5, which was designed to examine which patient, clinical, or health system factors were predictors of receipt of at least the majority of appropriate psychosocial contacts, was not run because no factors were identified in Aim 3 as potential predictors.

Model 1 was designed to examine which patient, clinical, or health system factors were predictors of receipt of at least one appropriate psychosocial contact. Only one health system factor (number of automated notifications that needed follow-up) was identified in Aim 3 as a potential predictor of receipt of at least one appropriate psychosocial contact and was entered into Model 1. Table 8 reports logistic regression statistics for Model 1. For model 1, number of automated notifications that needed follow-up was found to be a statistically significant predictor of receipt of at least one appropriate psychosocial contact (*OR* = 1.97, *p* = .003; *95% CI* = 1.26-3.08). For every additional automated notification generated by SupportScreen that needed follow-up, the odds of receiving at least one appropriate psychosocial contact are multiplied by 1.97.

## Specific Aim 5

Specific Aim 5a was to identify for individuals screened, identified as distressed, and who received at least one appropriate psychosocial contact, which patient, clinical, and health system factors predict time to receipt of first appropriate psychosocial contact; as well as to identify for individuals screened, identified as distressed, and who received at least one appropriate psychosocial service, which patient, clinical, and health system factors predict the time to receipt of first appropriate psychosocial service. Specific Aim 5b was to explore, for individuals screened, identified as distressed, and who received at least one appropriate psychosocial service, whether race/ethnicity and highest level of education moderate the relationship between type of first appropriate psychosocial service and the outcome time to receipt of first appropriate psychosocial service. Due to small and unequal sub-group sample sizes, planned models for regression analyses predicting or exploring moderators in the context of time to receipt of appropriate psychosocial services following distress screening are not reported here (Models 10, 11, 12; these results are included in a supplement that is available by request from the author).

Model 9 used multiple Cox regression and included the following patient, clinical, and health system factors identified in Aim 3 as potential predictors of time to receipt of first appropriate psychosocial contact following distress screening: number of automated notifications that needed follow-up and type of first appropriate psychosocial contact. Results for Model 9 are presented in Table 9. First, multi-collinearity of predictor variables was tested. There was a significant moderate negative correlation between number of automated notifications that needed follow-up and type of first appropriate psychosocial contact ($r_{pb}$ = -.36 $p$ = .004). Due to the fact that these variables were only moderately correlated (and not highly correlated), both predictors were still entered into the regression model. Findings for this multiple Cox regression model were at first not interpretable due to small sub-group sample size for the variable: type of first appropriate psychosocial contact, with subgroups $n$ = 3 from financial counselors, $n$ = 13 from community resources coordinators, and $n$ = 47 from social workers, (i.e., $n$ = 3 for sub-group category financial counselors, constituted less than 10% of $n$ = 63 sample size for model). Resultantly, researchers dropped from analysis the 3 cases with first appropriate psychosocial contact from financial counselors and re-ran Model 9. For Model 9, Cox proportionality of hazards assumption was met. Type of first appropriate psychosocial contact was found to be a significant predictor of time to receipt of first appropriate psychosocial contact (*OR* = 0.23, *p* < .001; *95% CI* = 0.11-0.48), such that receiving an automated notification for community resources coordinators (vs. social workers) was associated with shorter time to receipt of first appropriate psychosocial contact. At any given time, individuals receiving an automated notification for social workers are 77% less likely than individuals receiving an automated notification for community resources coordinators to receive an appropriate psychosocial contact. Number of automated notifications that needed follow-up was not found to be a significant predictor of time to first appropriate psychosocial contact (*p* > .05).

Given that researchers were unable to report planned regression analyses predicting receipt of psychosocial service variables due to small and unequal sub-group sample sizes, the researchers included one additional set of simplified descriptive analyses to characterize individuals who received versus did not receive at least one appropriate psychosocial service. Table 10 reports results of chi-square tests characterizing dichotomized patient, clinical, and health system factors and the outcome variable receipt of at least one appropriate psychosocial service. There were no significant differences between individuals who did and did not receive at least one appropriate psychosocial service according to dichotomized patient, clinical, and health system factors.

Results, in part is currently being prepared for submission for publication of the material. Ustjanauskas, Amy E.; Malcarne, Vanessa L.; Wells, Kristen J.; Clark, Karen; Obenchain, Richard; Loscalzo, Matthew J.; Roesch, Scott C.; Sadler, Georgia R. The dissertation author was the primary investigator and author of this material.

## Discussion

The prevalence and negative impact of psychosocial distress on cancer patients have been noted by several national organizations as important public health problems (American College of Surgeons, 2012; Institute of Medicine, 2008; National Comprehensive Cancer Network, 2017). Resultantly, organizations have issued guidelines requiring accredited cancer centers to implement distress screening programs (American College of Surgeons, 2012). The implementation of these guidelines has been variable due both to the lack of specific implementation guidance provided in guidelines as well as the paucity of comprehensive, quality research in this area. One area in particular that has been noted by experts as critical to improving distress screening processes is understanding what happens after screening and referrals (Mitchell, 2013); that is, examining whether distressed cancer patients are being connected to appropriate evidence-based psychosocial services. However, previous research in this area is scant, particularly within the United States, with studies rarely exploring this research question in depth, and infrequently reporting type of psychosocial services received, time to receipt, or predictors of receipt. The current study addressed this gap in the literature by comprehensively exploring outcomes of distress screening, namely: generation of automated printed educational materials and automated notifications for psychosocial providers; receipt of and time to appropriate written referrals, psychosocial contacts, and psychosocial services; as well as predictors of receiving appropriate psychosocial contacts and services following distress screening.

The current study found that nearly all patients screened (97.99%) were identified as distressed. Other research has estimated that 35% of cancer patients experience clinically significant levels of distress, broadly defined, and 19% and 13% meet clinical levels of anxiety and depression, respectively (Linden & Girgis, 2012; Zabora et al., 2001). This suggests that SupportScreen may be over-identifying the true number of individuals who are clinically distressed in this study. This may be due to several reasons. First, distress is a broadly-defined construct and there is a lack of consensus in the field on how exactly it should be defined. City of Hope uses a broad definition of distress. They include a wide array of physical, practical, social, psychological, and spiritual components in their definition of distress (Loscalzo et al., 2010), which may be a factor contributing to the high rate of cancer patients identified as distressed in the current study. Second, distress can be measured with a variety of instruments that vary according to specificity and sensitivity, which can lead to over- or under-identification of distressed cancer patients (Vodermaier et al., 2009). Future research evaluating the psychometric properties of the version of SupportScreen used in the current study is needed to better understand its accuracy in identifying cancer patients who are experiencing clinical levels of distress.

The current study also found that all 146 patients screened and identified as distressed by SupportScreen received automated printed educational materials designed to address their distress-related problems. This is promising, as all distressed patients received tailored educational resources in real-time; however, additional research is needed to explore whether the hospital's educational materials are used by patients or effective in reducing cancer patients' distress. Additionally, all 146 distressed patients' SupportScreens generated at least one automated notification for a psychosocial provider; meaning that every single patient screened and identified as distressed required attention by a psychosocial provider. Even after social workers implemented their own systematic process to determine whether or not follow-up was needed for automated notifications generated for their department, more than two-thirds (69.12%) of the study sample needed follow-up by psychosocial providers. The rate of screened patients needing follow-up by a psychosocial provider found in the current study is higher than rates reported in other distress screening studies, which ranged from 12 to 57% (Braeken et al., 2011; Funk et al., 2016; Grassi et al., 2011; Hammelaf et al., 2013; Ito et al., 2011; Johnson et al., 2010; Shimuzu et al., 2010). In addition to the fact that City of Hope uses a broad definition of distress and that additional research is needed exploring the psychometric properties of the version of SupportScreen used in the current study, the high rate of cancer patients requiring follow-up post-screening in this study is also likely due to City of Hope's low threshold for determining whether or not follow-up is needed. Generally, City of Hope requires follow-up post-screening if one or more of the 30 items on SupportScreen are endorsed as either a "Moderate Problem" or higher, or, as an area the patient would like to receive additional information or speak to a member of the team about. This low threshold for determination of follow-up may be a factor contributing the high rates of patients needing follow-up at City of Hope.

The current study also found that of the 103 distressed patients needing follow-up by a psychosocial provider less than two-thirds received at least one appropriate psychosocial contact, less than one-half received at least the majority of appropriate psychosocial contacts, and less than one-fifth received all appropriate psychosocial contacts. Further, only one in ten patients received at least one appropriate psychosocial service, only one in twenty received at least the majority of psychosocial services, and only one in thirty received all appropriate psychosocial services. Patients who did receive appropriate psychosocial contacts and services, however, did receive them in a timely fashion (on average 8.19 and 4.82 days post-screening, respectively). Other distress screening studies in the United States reported a wide range (50-100%) for the percent of patients screened and identified as distressed who received appropriate psychosocial contacts or services following distress screening (Azuero et al., 2014; Funk et al., 2016; Hammelaf et al., 2013; Johnson et al., 2010). However, it is difficult to compare the rates of receipt of appropriate psychosocial contacts and services following distress screening from the current study to these other studies, due to the fact that many of these other U.S. studies do not report receipt of appropriate psychosocial contacts and services separately, or do not specify which of these two outcomes they are referring to when they indicated that a patient received services. For instance, Johnson et al. (2010) reported that all 82 women in their study with gynecologic cancer who were screened and identified as distressed received psychosocial assessment or intervention following distress screening; however, it is unclear if these services were conducted in-person or via phone. Regardless, the rate of appropriate psychosocial contacts or services reported in Johnson's study (100%) is higher than that which was reported in the current study for either contacts or services. Hammelaf et al. (2013) similarly did not specify whether services were delivered via telephone or in-person, but reported that 59% of patients who were screened and identified as distress received psychosocial services on average within 2.7 days of distress screening. Again, while it is difficult to compare these findings to the current study, it appears that patients in the Hammelaf et al. study received appropriate psychosocial contacts or services more quickly than the current study. Azuero et al. (2014) found that among female cancer patients screened and identified as distressed in a palliative care unit, 50% received in-person psychology services within three years of distress screening. Azuero et al. reported a higher rate of receipt of appropriate psychosocial services as compared to the current study. However, this may be accounted for by the fact that Azuero et al. investigated receipt of services during a much longer post-screening follow-up period as compared to the current study (three years vs. 30 days, respectively); it is unclear why Azeuro et al. explored receipt of services during such a long follow-up period. Funk et al. (2016) reported that 50% of cancer patients screened for distress received a psychosocial contact and 11% received a psychosocial service within 14 days post-screening. The Funk et al. (2016) findings are comparable to the current study's findings that 61.17% and 10.68% of distressed patients needing follow-up received at least one appropriate psychosocial contact and at least one appropriate psychosocial service, respectively. Future research clearly documenting these rates is important to better understand outcomes of distress screening and ways to improve existing distress screening processes.

While the current study added to the scant distress screening literature conducted in the United States documenting receipt of appropriate contacts and services post-screening, future research is also needed to better understand why so few patients received calls and services following engagement in City of Hope's distress screening process. With regard to calls, it is possible that psychosocial providers were overwhelmed by the high number of automated notifications needing follow-up and were not able to address all of them within 30 days post-screening. It is also possible that psychosocial providers habituated to the notifications given that all distressed patients received automated notifications for at least one psychosocial provider. Further, the low rates of receipt of psychosocial services may be due to a variety of reasons including that: assessment and intervention was conducted over the phone and no in-person service was needed; the patient declined additional psychosocial services during the phone contact; or the patient was unable to be reached. Future research identifying the nature of psychosocial contacts and services received by patients would be helpful to better understand why only some cancer patients are receiving appropriate aftercare following distress screening.

The current study not only reported receipt of appropriate follow-up post-screening for all types of providers combined, but it also provided detailed information regarding how receipt of follow-up varied by psychosocial provider type as well as what predicts follow-up. For example, while automated notifications were generated for both nutrition and rehabilitation specialists, no appropriate written referrals were received by patients for nutrition specialists and only two appropriate written referrals were received by patients for rehabilitation specialists. These findings demonstrate that providers are deciding in only a few instances to write written referrals for nutrition and rehabilitation specialists. Future research exploring why nutrition and rehabilitation specialists are not writing written referrals would be helpful to improve existing distress screening processes. With regard to receipt of appropriate psychosocial contacts, only community resources coordinators and social workers called the majority of patients with automated notifications generated for their respective departments. Patients with automated notifications for financial counselors received less than 10% of appropriate psychosocial contacts; and patients with automated notifications for rehabilitation specialists, nutrition specialists, and spiritual care specialists/chaplains received no appropriate psychosocial contacts. While community resources coordinators and social workers are calling a substantial number of patients with automated notifications for their respective departments, most types of psychosocial providers are not calling patients to follow-up on automated notifications. Further, less than 10% of patients with automated notifications for social workers and financial counselors received appropriate psychosocial services; only one patient with an automated notification for rehabilitation specialists received the appropriate psychosocial service; and no patients with automated notifications for community resources coordinators, spiritual care specialists/chaplains, or nutrition specialists received appropriate psychosocial services.

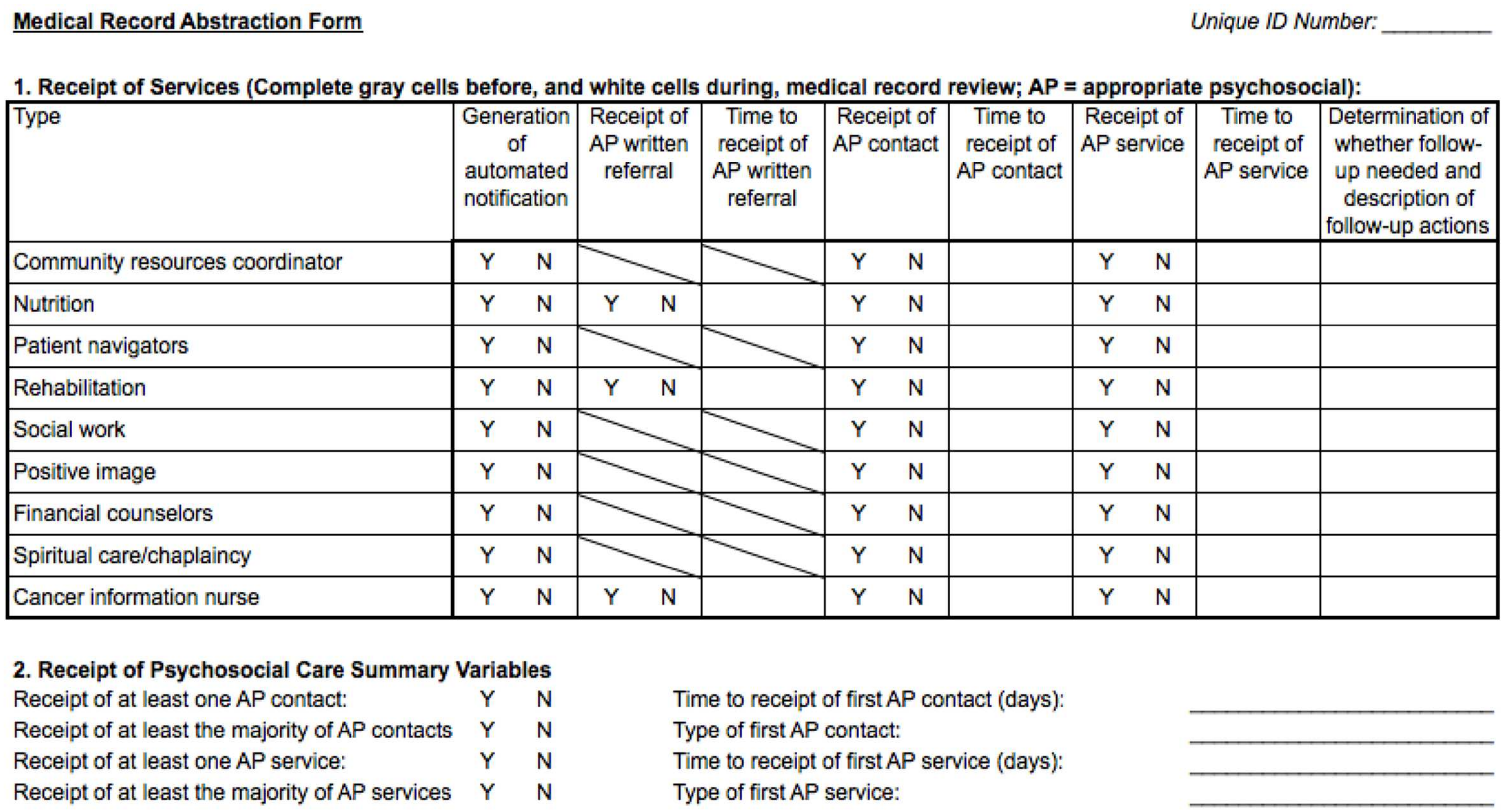
Due to the small number of individuals receiving services, it was not possible to examine predictors of appropriate psychosocial services post-screening, although it was possible to examine predictors of appropriate psychosocial contacts. The number of automated notifications that needed follow-up predicted receipt of at least one appropriate psychosocial contact post-screening. Further, the current study found that only type of first appropriate psychosocial contact predicted time to receipt of first appropriate psychosocial contact post-screening, such that receiving an automated notification for community resources coordinators (vs. social workers) was associated with shorter time to receipt of first appropriate psychosocial contact. This finding may be accounted for by the higher number of automated notifications generated for social workers versus community resources coordinators (146 vs. 26) as well as the systematic process employed by social workers to determine whether each automated notification required follow-up, both of which may have contributed to longer times between screening and contact for social workers as compared to community resources coordinators. Only one other distress screening study conducted in the United States explored predictors of receipt of follow-up care following distress screening (Azuero et al., 2010). Azuero et al. (2010) found that among female cancer patients screened and identified as distressed in a palliative care unit, total number of palliative care visits; younger age; seeing multiple providers; taking non-opioid analgesics; having a diagnosis of pancreas, gall bladder, or kidney disease comorbidity; and higher body mass index were significant predictors of psychology service utilization post-screening. Azuero et al. (2016) did not explore number or type of automated notifications as predictors of receipt of follow-up post-screening, but Azuero et al.'s findings that number of palliative care visits and seeing multiple providers predicted receipt of psychology services following distress screening are consistent with the current study's finding that number of automated notifications predicted receipt of appropriate psychosocial contacts. It is not surprising that greater numbers of automated notifications (or visits, which would likely allow for more opportunities for notifications or referrals to be generated), would lend to higher rates of receipt of follow-up care post-screening. The current study was unable to explore predictors of receipt of appropriate psychosocial services due to small sample size, but the current study did examine differences between individuals who received or did not receive at least one appropriate psychosocial service; no group differences were found.

While this study addressed major gaps in the distress screening literature by comprehensively evaluating receipt of, time to, and predictors of appropriate written referrals, appropriate psychosocial contacts, and appropriate psychosocial services following distress screening, it also has its limitations. The study sample was comprised mainly of female English-speaking patients, who were not from medically underserved racial/ethnic groups, had private insurance, had completed any college education or more, were receiving care at a comprehensive cancer center in the Southwestern portion of the United States, and had been screened with a particular distress screening instrument (SupportScreen). Study findings may not be generalizable to patients of diverse socio-demographic backgrounds screened for distress using different distress screening instruments in different cancer settings or geographic locations. Further, participants in this study included patients who declined participation in a separate study conducted by City of Hope; it is possible that participants in the current study may have characteristics different from other patients at City of Hope. Additionally, future research at City of Hope exploring receipt of appropriate psychosocial contacts and services following distress screening should be conducted using larger sample sizes, as some analyses in the current study were unable to be conducted due to small sample size. Further, another limitation of the current study is the possibility of Type I Error given the number of analyses conducted. The researchers chose to not alpha-correct given the limitations of *p*-values, but instead presented odds ratios and effect sizes. Additionally, the current study was unable to explore receipt of written referrals, contacts, and services for particular psychosocial providers who did not document receipt of care for individual patients in medical records during the study time period (patient navigators, positive image specialists, cancer information nurses); if these departments begin recording receipt of written referrals, contacts, and services in the future, it would be helpful to summarize outcome data for these departments. It is also possible that psychosocial contacts or services were provided (e.g., a brief discussion by a psychosocial provider during another visit) that were not documented in the medical record. Further, this study only evaluated receipt of written referrals, contacts, and services within 30 days post-screening. While 30 days was chosen as it is City of Hope's standard of care for the timeframe in which psychosocial services should be received following screening, it would be interesting to explore whether or not written referrals, contacts, or services are received following 30 days post-screening. It would also be helpful to note the content of the psychosocial contact or service received by patients (e.g., assessment; evidence-based intervention; resources provided; discussion where client declined services, and if so, why client declined services, etc.) as well as whether or not resources or interventions provided are effective in reducing patients' distress. Future research in this area using stronger study designs would also be beneficial to explore causal relationships between distress screening and receipt of follow-up care. Future research also including post-measures of distress following screening, referral, and receipt of care would also be helpful to understand whether the entire distress screening process (i.e., screening, triage, and receipt of services) leads to reductions in distress among cancer patients.

To conclude, this study found that nearly all patients screened were identified as distressed. While all patients screened and identified as distressed received automated printed educational materials, only some patients received appropriate psychosocial contacts, and few received appropriate psychosocial services following distress screening. It also found that, among patients who received appropriate psychosocial contacts and services, contacts and services were received in a timely fashion. Finally, the study found that the number of automated notifications that needed follow-up was a statistically significant predictor of receipt of at least one appropriate psychosocial contact and type of first appropriate psychosocial contact was a statistically significant predictor of time to receipt of first appropriate psychosocial contact. These findings suggest that this particular approach to distress screening is very effective in providing distressed cancer patients with automated printed educational materials tailored to their identified problems, but it is less effective in connecting patients to appropriate contacts and services. Provision of evidence-based aftercare has been identified by experts as one of the main barriers to successful implementation of distress screening processes, despite the fact that evidence-based aftercare shown to reduce distress in cancer patients does exist (Faller et al., 2013; Mitchell, 2013). Given this and the current study's findings, it is imperative that further research be conducted with larger, more diverse samples of cancer patients in various settings exploring best ways to identify cancer patients that are distressed and in need of follow-up as well as receipt, timing, and predictors of appropriate psychosocial contacts and services following distress screening. It is also essential that research evaluate whether or not the services provided to cancer patients following distress screening are effectively reducing patients' distress. Continued future research is needed in this area to improve distress screening processes nationwide and better meet the psychosocial needs of distressed cancer patients.

Discussion, in part is currently being prepared for submission for publication of the material. Ustjanauskas, Amy E.; Malcarne, Vanessa L.; Wells, Kristen J.; Clark, Karen; Obenchain, Richard; Loscalzo, Matthew J.; Roesch, Scott C.; Sadler, Georgia R. The dissertation author was the primary investigator and author of this material.

# Appendix 1: Figures



**Medical Record Abstraction Form**

*Unique ID Number:* _________

**1. Receipt of Services (Complete gray cells before, and white cells during, medical record review; AP = appropriate psychosocial):**

| Type | Generation of automated notification | Receipt of AP written referral | Time to receipt of AP written referral | Receipt of AP contact | Time to receipt of AP contact | Receipt of AP service | Time to receipt of AP service | Determination of whether follow-up needed and description of follow-up actions |
|---|---|---|---|---|---|---|---|---|
| Community resources coordinator | Y N | | | Y N | | Y N | | |
| Nutrition | Y N | Y N | | Y N | | Y N | | |
| Patient navigators | Y N | | | Y N | | Y N | | |
| Rehabilitation | Y N | Y N | | Y N | | Y N | | |
| Social work | Y N | | | Y N | | Y N | | |
| Positive image | Y N | | | Y N | | Y N | | |
| Financial counselors | Y N | | | Y N | | Y N | | |
| Spiritual care/chaplaincy | Y N | | | Y N | | Y N | | |
| Cancer information nurse | Y N | Y N | | Y N | | Y N | | |

**2. Receipt of Psychosocial Care Summary Variables**

| | | |
|---|---|---|
| Receipt of at least one AP contact: | Y | N |
| Receipt of at least the majority of AP contacts | Y | N |
| Receipt of at least one AP service: | Y | N |
| Receipt of at least the majority of AP services | Y | N |

Time to receipt of first AP contact (days): ____________________

Type of first AP contact: ____________________

Time to receipt of first AP service (days): ____________________

Type of first AP service: ____________________

*Figure 1.* Medical Record Abstraction Form

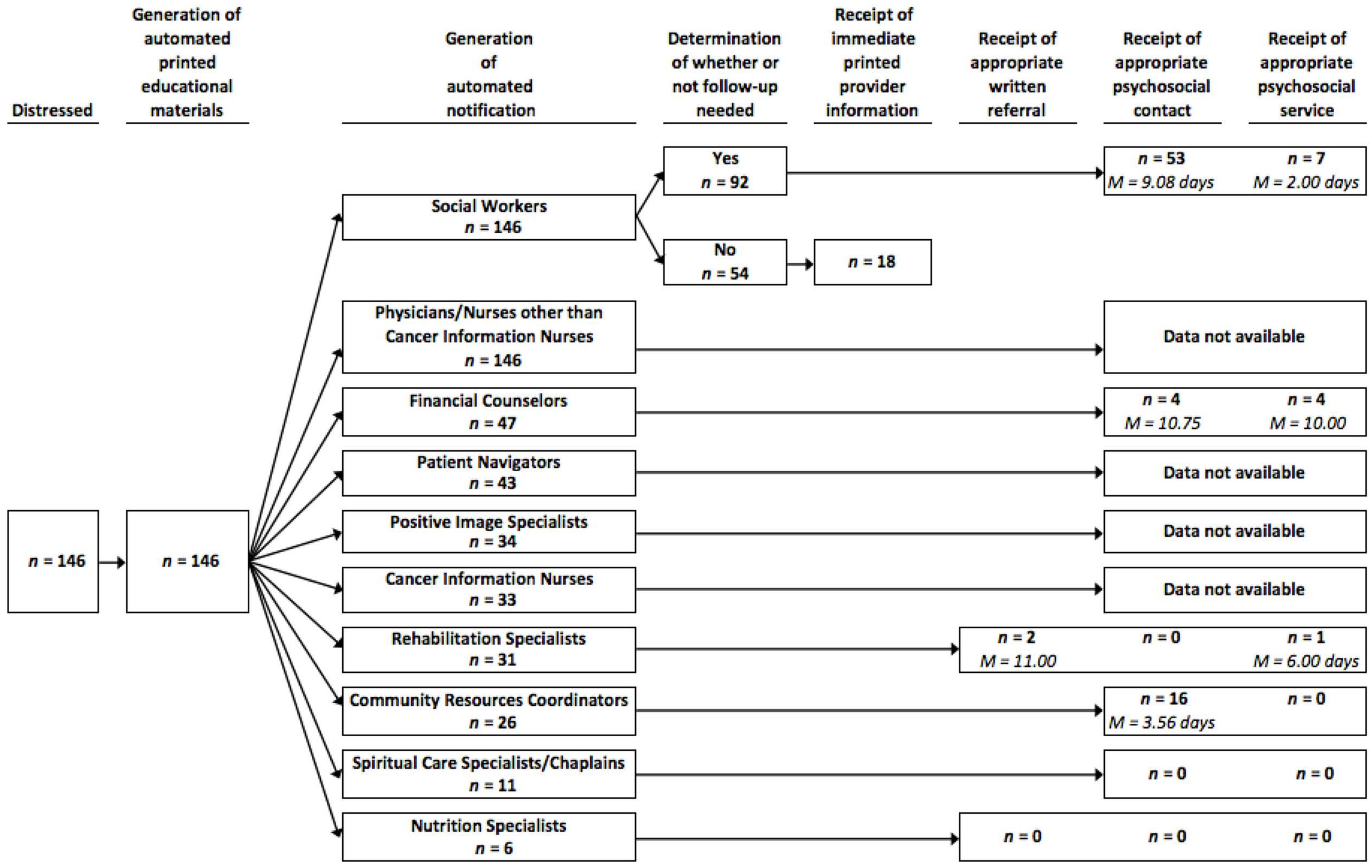


*Figure 2*. Automated triaging actions and distress screening outcomes, for each type of automated notification generated (N = 146 patients screened and identified as distressed)

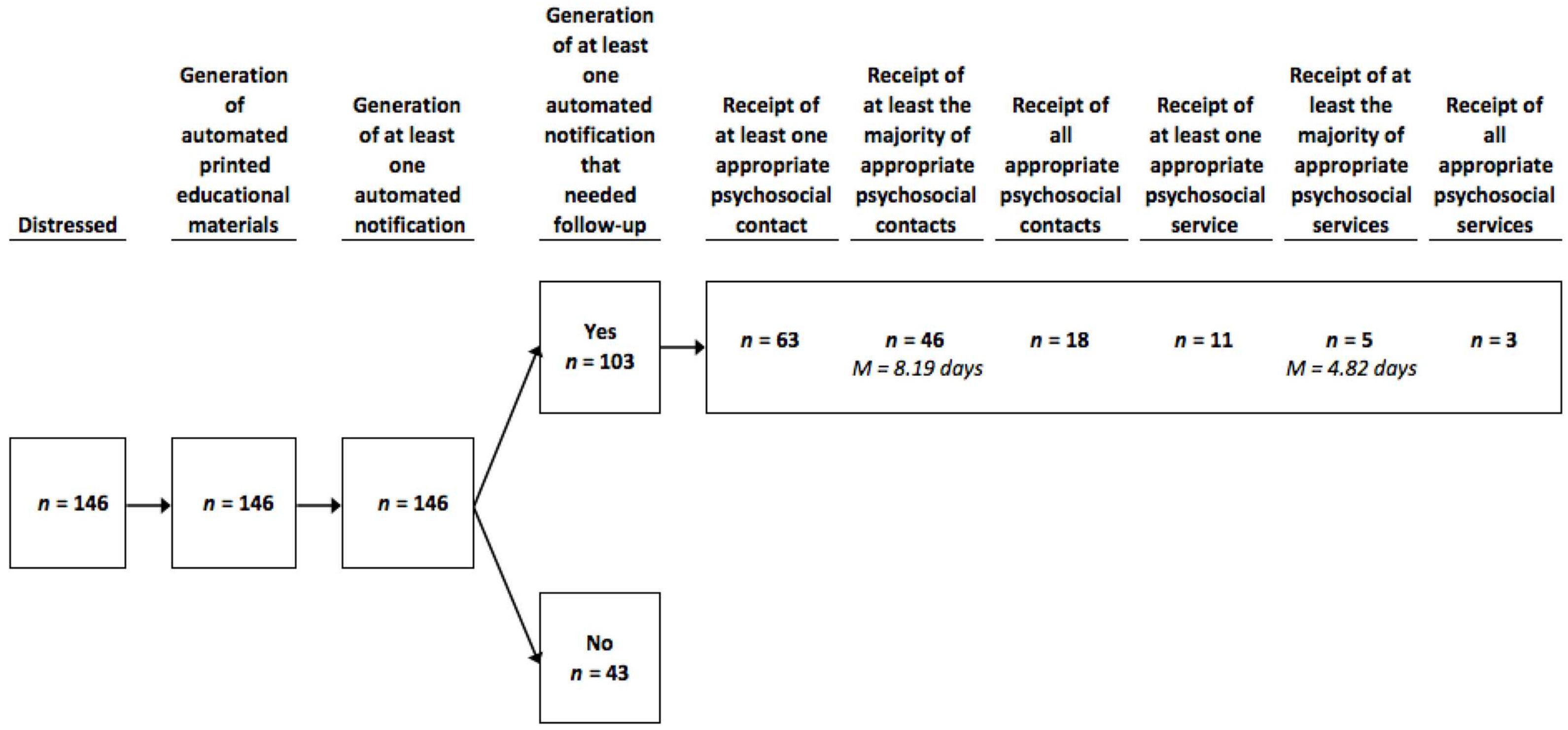


*Figure 3.* Automated triaging actions and distress screening outcomes, for all automated notifications combined (N = 146 patients screened and identified as distressed)

## Appendix 2: Tables

*Table 1.* Variables and Descriptions

| Name | Definition (if not self-explanatory from variable name) | Response Options |
|---|---|---|
| A. Patient and clinical factor variables | | |
| Highest level of education | - | <u>Dichotomous:</u><br>High school graduate or less<br>Any college education or more |
| Race/Ethnicity | - | <u>Dichotomous:</u><br>From a medically underserved racial/ethnic group (i.e., identified as Black/African American, Latino/ Hispanic, Asian, Pacific Islander, Southeast Asian, Native American/ Alaskan, and/or Other)<br>Not from a medically underserved racial/ethnic group (i.e., identified as European American/Caucasian) |
| Preferred language | - | <u>Dichotomous:</u><br>English<br>Other |
| Insurance status | - | <u>Categorical:</u><br>Private insurance only<br>Medicare and/or Medi-Cal (no private insurance)<br>Private insurance AND Medicare and/or Medical<br>None |
| Age | - | <u>Continuous:</u><br>18 years to maximum in sample |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| Gender | - | Dichotomous:<br>Male<br>Female |
| Type of cancer | - | Categorical:<br>Breast<br>Male genital system<br>Urinary system<br>Female genital system<br>Other cancers (i.e., cancer types for which *n* is less than or equal to five) |
| Distressed | Whether or not SupportScreen identified patient as distressed | Dichotomous:<br>Yes<br>No |
| B. Health system factor variables | | |
| Generation of any type of automated triaging action | Whether or not SupportScreen generated any type of automated triaging action for a given patient (i.e., automated printed educational materials and/or automated notification for a psychosocial provider) | Dichotomous:<br>Generation of any type of automated triaging action<br>Generation of no automated triaging action |
| Type of automated triaging action | Type of automated triaging action generated for a given patient | Categorical:<br>Generation of automated printed educational materials and automated notification for a psychosocial provider<br>Generation of automated printed educational materials only<br>Generation of automated notification for a psychosocial provider only |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| Types of automated notifications | For a given patient, types of automated notifications refer to the types of psychosocial providers that the automated notifications were generated for | <u>Categorical</u>:<br>Social workers<br>Financial counselors<br>Patient navigators<br>Rehabilitation specialists<br>Positive image specialists<br>Cancer information nurses<br>Community resources coordinators<br>Spiritual care specialists/chaplains<br>Nutrition specialists<br>Physicians/Nurses (other than cancer information nurses) |
| Generation of at least one automated notification | Total number of automated notifications generated for a given patient is greater than or equal to 1 | <u>Dichotomous:</u><br>Yes<br>No |
| C. Outcome variables (calculated for a given patient, for each type of automated notification generated) | | |
| Receipt of appropriate written referral | For each type of automated notification generated for a given patient, whether or not the same type of written referral was documented in the patient's medical record within 30 days post- screening (e.g., if automated notification is for nutrition specialists, same type means that written referral was also for nutrition specialists). Note: this variable only applies to rehabilitation and nutrition specialists | <u>Dichotomous</u>:<br>Yes<br>No |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| Time to receipt of appropriate written referral | For each type of appropriate written referral received by a given patient within 30 days post-screening, this variable refers to the number of days from screening to documentation in medical record of first appropriate written referral of same type (e.g., if a patient's SupportScreen generated an automated notification for nutrition specialists on 3/1 and the first written referral for nutrition specialists was documented on 3/7, time to receipt of appropriate written referral = 6 days)<br>Note: this variable only applies to rehabilitation and nutrition specialists | <u>Continuous</u>:<br>0 to 30 days |
| Receipt of appropriate psychosocial contact | For each type of automated notification generated for a given patient, whether or not the same type of psychosocial contact (i.e., phone contact) was documented in the patient's medical record within 30 days post-screening (e.g., if automated notification is for social work, same type means that psychosocial contact was also for social work) | <u>Dichotomous</u>:<br>Yes<br>No |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| Time to receipt of appropriate psychosocial contact | For each type of automated notification generated for a given patient, this variable refers to the number of days from screening to documentation in medical record of first appropriate psychosocial contact of same type (e.g., if a patient's SupportScreen generated an automated notification for social work on 3/1 and the first social work phone contact received by patient was on 3/3, time to receipt of appropriate psychosocial contact = 2 days) | <u>Continuous</u>:<br>0 to 30 days |
| Receipt of appropriate psychosocial service | For each type of automated notification generated for a given patient, whether or not the same type of psychosocial service (i.e., in-person service) was documented in the patient's medical record within 30 days post-screening (e.g., if automated notification is for social work, same type means that in-person service was also for social work) | <u>Dichotomous</u>:<br>Yes<br>No |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| Time to receipt of appropriate psychosocial service | For each type of automated notification generated for a given patient, this variable refers to the number of days from screening to documentation in medical record of first appropriate psychosocial contact of same type (e.g., if a patient's SupportScreen generated an automated notification for social work on 3/1 and the first social work in-person service received by patient was on 3/6, time to receipt of appropriate psychosocial service = 5 days) | <u>Continuous</u>:<br>0 to 30 days |
| Determination of whether or not follow-up needed and description of follow-up actions | Common practice at City of Hope is that individuals who are screened and identified as distressed, and whose SupportScreen generated an automated notification for a psychosocial provider, receive follow-up from that psychosocial provider (i.e., an appropriate written referral, appropriate psychosocial contact, and/or appropriate psychosocial service).<br>For any psychosocial provider types who had a systematic process to | Open-ended |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| | determine whether or not follow-up was needed for a given automated notification (that was different from the common practice described above), the researcher documented the department-specific determination of whether or not follow-up was needed. Then, the researcher recorded any follow-up actions provided to patients other than appropriate written referrals, contacts, and services.<br>Note: social workers were the only psychosocial providers to engage in a separate systematic process that differed from the common practice to determine whether or not follow-up was needed for a given automated notification | |
| Determination of whether or not follow-up needed | Based on the variable, "Determination of whether or not follow-up needed and description of follow-up actions," the researcher coded the determination of whether or not follow-up was needed for a given notification as yes or no.<br>Note: this only applied to social workers | <u>Dichotomous</u><br>Yes<br>No |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| D. Outcome and other summary variables (summary variables refer to the fact that for a given patient these variables are not calculated for each type of automated notification generated, but for all automated notifications combined) | | |
| Number of automated notifications that needed follow-up[a] | For a given patient, total number of automated notifications for which follow-up (i.e., appropriate written referrals, appropriate psychosocial contacts, and/or appropriate psychosocial services) is needed, for all automated notifications combined. This variable takes into account social workers' determinations of whether or not follow-up was needed for a given automated notification for social workers. E.g., if a patient's SupportScreen generated automated notifications for nutrition specialists and community resources coordinators, as well as an automated notification for social workers that was determined by social workers to not need follow-up, number of automated notifications that needed follow-up = 2. | Continuous:<br>0 to maximum in sample |
| Generation of at least one automated notification that needed follow-up[a] | For a given patient, number of automated notifications that needed follow-up is greater than or equal to 1. | Dichotomous:<br>Yes<br>No |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| Receipt of at least one appropriate psychosocial contact | For a given patient, at least one appropriate psychosocial contact was received | <u>Dichotomous:</u><br>Yes<br>No |
| Receipt of at least the majority of appropriate psychosocial contacts | For a given patient, at least the majority of appropriate psychosocial contacts were received (i.e., 50% or more of appropriate psychosocial contacts were received) | <u>Dichotomous:</u><br>Yes<br>No |
| Receipt of all appropriate psychosocial contacts | For a given patient, 100% of appropriate psychosocial contacts received | <u>Dichotomous:</u><br>Yes<br>No |
| Time to receipt of first appropriate psychosocial contact | For a given patient, across all automated notifications generated, this variable refers to the minimum number of days from screening to appropriate psychosocial contact (e.g., for a given patient, if SupportScreen generated notifications for social work and nutrition specialists on 3/1, and the patient received appropriate psychosocial contacts from social work on 3/3 and nutrition specialists on 3/7, time to receipt of first appropriate psychosocial contact = 2 days) | <u>Continuous:</u><br>0 to 30 days |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| Type of first appropriate psychosocial contact[a] | For a given patient, type of first appropriate psychosocial contact (e.g., if a given patient received appropriate psychosocial contacts from social work 2 days post-screening and from nutrition 3 days post-screening, type of first appropriate psychosocial contact = social work) | <u>Categorical:</u><br>Social workers<br>Financial counselors<br>Patient navigators<br>Rehabilitation specialists<br>Positive image specialists<br>Cancer information nurses<br>Community resources coordinators<br>Spiritual care specialists/chaplaincy<br>Nutrition specialists |
| Receipt of at least one appropriate psychosocial service | For a given patient, at least one appropriate psychosocial service was received | <u>Dichotomous:</u><br>Yes<br>No |
| Receipt of at least the majority of appropriate psychosocial services | For a given patient, at least the majority of appropriate psychosocial services were received (i.e., 50% or more of appropriate psychosocial services were received) | <u>Dichotomous:</u><br>Yes<br>No |
| Receipt of all appropriate psychosocial services | For a given patient, 100% of appropriate psychosocial services received | <u>Dichotomous:</u><br>Yes<br>No |

*Table 1.* Variables and Descriptions, Continued

| **Name** | **Definition (if not self-explanatory from variable name)** | **Response Options** |
|---|---|---|
| Time to receipt of first appropriate psychosocial service | For a given patient, across all automated notifications generated, this variable refers to the minimum number of days from screening to appropriate psychosocial contact (e.g., for a given patient, if SupportScreen generated notifications for social work and nutrition specialists on 3/1, and the patient received appropriate psychosocial services from social work on 3/5 and nutrition specialists on 3/8, time to receipt of first appropriate psychosocial service = 4 days) | <u>Continuous:</u><br>0 to 30 days |
| Type of first appropriate psychosocial service[a] | For a given patient, type of first appropriate psychosocial service (e.g., if a given patient received appropriate psychosocial services from social work 2 days post-screening and from nutrition 5 days post-screening, type of first appropriate psychosocial service = social work) | <u>Categorical:</u><br>Social workers<br>Financial counselors<br>Patient navigators<br>Rehabilitation specialists<br>Positive image specialists<br>Cancer information nurses<br>Community resources coordinators<br>Spiritual care specialists/chaplaincy<br>Nutrition specialists |

[a] Variable is a health system factor summary variable.

*Table 2.* Participant Characteristics (*N* = 149)

| Participant characteristic variable | *n (%)* |
|---|---|
| Distressed[a] | |
| Yes | 146 (97.99) |
| No | 3 (2.01) |
| Age in years | 61.30 (13.56)[b] |
| Gender | |
| Female | 85 (57.05) |
| Male | 64 (42.95) |
| Race/Ethnicity | |
| Caucasian | 109 (73.15) |
| Asian | 22 (14.77) |
| Black | 13 (8.72) |
| Native American | 1 (0.67) |
| Unknown | 4 (2.68) |
| Highest level of education | |
| Completed college | 46 (30.87) |
| Some college | 42 (28.19) |
| Beyond college | 22 (14.77) |
| Completed high school | 22 (14.77) |
| Some high school | 8 (5.37) |

*Table 2.* Participant Characteristics (*N* = 149), Continued

| Participant characteristic variable | *n (%)* |
|---|---|
| Less than high school | 4 (2.68) |
| Unknown | 5 (3.36) |
| Preferred language | |
| English | 133 (89.26) |
| Other | 16 (10.74) |
| Insurance status | |
| Private insurance only | 74 (49.66) |
| Medicare and/or Medical (no private insurance) | 26 (17.45) |
| Private insurance AND Medicare and/or Medical | 23 (15.44) |
| No insurance | 26 (17.45) |
| Type of cancer | |
| Breast | 65 (43.62) |
| Male genital system | 45 (30.20) |
| Urinary system | 13 (8.72) |
| Female genital system | 11 (7.38) |
| Other cancers – subgroup n less than or equal to five | 15 (10.07) |

[a] Identified as distressed by SupportScreen.

[b] *M* (*SD*).

*Table 3.* Types of Automated Triaging Actions Generated by SupportScreen[a]

| Type of automated triaging action | *n (%)* |
|---|---|
| Generation of any type of automated triaging action[a] | 146 (100.00) |
| Generation of automated printed educational materials and an automated notification for a psychosocial provider | 146 (100.00) |
| Generation of no automated triaging action | 0 (00.00) |
| Generation of automated printed educational materials only | 0 (00.00) |
| Generation of automated notification for a psychosocial provider only | 0 (00.00) |
| Types of automated notifications | |
| Social workers | 146 (100.00) |
| Physicians/nurses other than cancer information nurses | 146 (100.00) |
| Financial counselors | 47 (32.19) |
| Patient navigators | 43 (29.45) |
| Positive image specialists | 34 (23.29) |
| Cancer information nurses | 33 (22.60) |
| Rehabilitation specialists | 31 (21.23) |
| Community resources coordinators | 26 (17.81) |
| Spiritual care specialists/chaplains | 11 (7.53) |
| Nutrition specialists | 6 (4.11) |

[a] *N* = 146 patients screened and identified as distressed.

[b] Any type of automated triaging action includes automated printed educational materials and/or an automated notification for a psychosocial provider.

*Table 4.* Number of Automated Notifications that Needed Follow-up[a]

| Number of automated notifications that needed follow-up | *n* (%) |
|---|---|
| 1 | 40 (38.83) |
| 2 | 31 (30.10) |
| 3 | 20 (19.42) |
| 4 | 9 (8.74) |
| 5 | 3 (2.91) |

[a] *N* = 103 patients screened and identified as distressed whose SupportScreen generated at least one automated notification that needed follow-up.

*Table 5*. Receipt of Appropriate Psychosocial Contacts and Services, Calculated for All Automated Notifications Combined[a]

| | *n* (%) |
|---|---|
| Receipt of at least one appropriate psychosocial contact | 63 (61.17) |
| Receipt of at least one appropriate psychosocial service | 11 (10.68) |
| Receipt of at least the majority of appropriate psychosocial contacts | 46 (44.66) |
| Receipt of at least the majority of appropriate psychosocial services | 5 (4.85) |
| Receipt of all appropriate psychosocial contacts | 18 (17.48) |
| Receipt of all appropriate psychosocial services | 3 (2.91) |

[a] *N* = 103 patients screened and identified as distressed whose SupportScreen generated at least one automated notification that needed follow-up.

*Table 6.* Time to Receipt of First Appropriate Psychosocial Contacts and Services, Calculated for All Automated Notifications Combined

| | Days<br>*M (SD)* |
|---|---|
| Time to receipt of first appropriate psychosocial contact[a] | 8.19 (6.17) |
| Time to receipt of first appropriate psychosocial service[b] | 4.82 (8.53) |

[a] *N* = 63 distressed patients who received at least one appropriate psychosocial contact.
[b] *N* = 11 distressed patients who received at least one appropriate psychosocial service.

*Table 7a.* Point-Biserial Correlations Between Continuous Patient, Clinical, and Health System Factors and Dichotomous Outcome Variables[a]

| | $r_{pb}$ | | | |
|---|---|---|---|---|
| Patient, clinical, or health system factor | Receipt of at least one appropriate psychosocial contact[b] | Receipt of at least one appropriate psychosocial service[b] | Receipt of at least the majority of appropriate psychosocial contacts[b] | Receipt of at least the majority of appropriate psychosocial services[b] |
| Age | .15 | -.04 | -.04 | -.001 |
| Number of automated notifications that needed follow-up | .31** | .24* | -.16 | -.14 |

*$p$ < .05. **$p$ < .01. ***$p$ < .001.

[a] $N$ = 103 patients screened and identified as distressed whose SupportScreen generated at least one automated notification that needed follow-up.

[b] Coded as 0 = No, 1 = Yes.

*Table 7b.* Chi-Square Tests Between Dichotomous/Categorical Patient and Clinical Factors and Dichotomous Outcome Variables[a]

| Patient and clinical factor | Receipt of at least one appropriate psychosocial contact[b] | | | | Receipt of at least one appropriate psychosocial service[b] | | | | Receipt of at least the majority of appropriate psychosocial contacts[b] | | | | Receipt of at least the majority of appropriate psychosocial services[b] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | *df* | *p* | *OR* | $\chi^2$ | *df* | *p* | *OR* | $\chi^2$ | *df* | *p* | *OR* | $\chi^2$ | *df* | *p* | *OR* |
| Gender[c] | 2.58 | 1 | .108 | 0.51 | 0.30 | 1 | .583 | 1.42 | 1.95 | 1 | .163 | 0.56 | 0.01 | 1 | .920 | 1.10 |
| Preferred language[d] | 0.07 | 1 | .797 | 0.86 | 0.21 | 1 | .645 | 1.65 | 0.19 | 1 | .665 | 0.78 | 0.18 | 1 | .668 | 0.61 |
| Race/ Ethnicity[e] | 2.57 | 1 | .109 | 2.13 | 0.04 | 1 | .852 | 0.88 | .077 | 1 | .781 | 1.13 | 2.22 | 1 | .136 | 0.93 |
| Highest level of education[f] | 0.34 | 1 | .559 | 0.75 | 0.02 | 1 | .882 | 1.13 | 0.18 | 1 | .669 | 1.23 | 0.14 | 1 | .709 | 0.63 |
| Insurance status[g,i] | 2.05 | 3 | .563 | - | 8.70* | 3 | .034 | - | 1.88 | 3 | .598 | - | 2.48 | 3 | .479 | - |
| Type of cancer[h,i] | 2.62 | 4 | .623 | - | 6.77 | 4 | .149 | - | 1.73 | 4 | .786 | - | 1.71 | 4 | .789 | - |

*$p < .05$. **$p < .01$. ***$p < .001$.

[a] $N = 103$ patients screened and identified as distressed whose SupportScreen generated at least one automated notification that needed follow-up.

[b] Coded as 0 = No, 1 = Yes.

[c] Coded as 0 = Female, 1 = Male.

[d] Coded as 0 = Other than English, 1 = English.

[e] Coded as 0 = Not from a medically underserved racial/ethnic group, 1 = From a medically underserved racial/ethnic group.

[f] Coded as 0 = High school graduate or less, 1 = Any college education or more.

[g] Coded as 1 = None, 2 = Medicare and/or Medical (No private insurance), 3 = Private insurance AND Medicare and/or Medical, 4 = Private insurance only.

[h] Coded as 1 = Breast, 2 = Female genital system, 3 = Male genital system, 4 = Other cancers (subgroup less than or equal to 5), 5 = Urinary system.

[i] Odds ratios not reported for patient and clinical factor variables with more than 2 levels.

*Table 7c.* Pearson Correlations Between Continuous Patient, Clinical, and Health System Factors and Continuous Outcome Variables

| | *r* | |
|---|---|---|
| Patient, clinical, or health system factor | Time to receipt of first appropriate psychosocial contact[a] | Time to receipt of first appropriate psychosocial service[b,c] |
| Age | -.13 | .45 |
| Number of automated notifications that needed follow-up | -.29* | -.10 |
| Time to receipt of first appropriate psychosocial contact | - | .77* |

*$p < .05$. **$p < .01$. ***$p < .001$.

[a] $N = 63$ distressed patients who received at least one appropriate psychosocial contact.

[b] $N = 11$ distressed patients who received at least one appropriate psychosocial service.

[c] Variable transformed using a square root transformation as original variable was not normally distributed.

*Table 7d.* Point-Biserial Correlations between Dichotomous Patient and Clinical Factors and Continuous Outcome Variables

| Patient or clinical factor | $r_{pb}$ | |
|---|---|---|
| | Time to receipt of first appropriate psychosocial contact[a] | Time to receipt of first appropriate psychosocial service[b,c] |
| Race/ Ethnicity[d] | -.17 | -.43 |
| Highest level of education[e] | -.17 | -.65 |
| Gender[f] | -.18 | -.01 |
| Preferred language[g] | -.24 | -.69* |

*$p < .05$. **$p < .01$. ***$p < .001$.

[a] $N = 63$ distressed patients who received at least one appropriate psychosocial contact.

[b] $N = 11$ distressed patients who received at least one appropriate psychosocial service.

[c] Variable transformed using a square root transformation as original variable was not normally distributed.

[d] Coded as 0 = Not from a medically underserved racial/ethnic group, 1 = From a medically underserved racial/ethnic group.

[e] Coded as 0 = High school graduate or less, 1 = Any college education or more.

[f] Coded as 0 = Female, 1 = Male.

[g] Coded as 0 = Other than English, 1 = English.

*Table 7e.* Analysis of Variance Tests Between Categorical Patient, Clinical, and Health System Factors and Continuous Outcome Variables

| Patient, clinical, or health system factor | Time to receipt of first appropriate psychosocial contact[a] | | | | Time to receipt of first appropriate psychosocial service[b,c] | | | |
|---|---|---|---|---|---|---|---|---|
| | *F* | *df* | *p* | $\eta_p^2$ | *F* | *df* | *p* | $\eta_p^2$ |
| Insurance status[d] | 0.30 | 3,59 | .824 | .015 | 0.47[e] | 1,9 | .511 | .050 |
| Type of cancer[f] | 0.97 | 4,58 | .430 | .063 | 0.09 | 2,8 | .913 | .023 |
| Type of first appropriate psychosocial contact[g] | 15.93[h]** | 2,5 | .006 | .221 | - | - | - | - |
| Type of first appropriate psychosocial service[i] | - | - | - | - | 1.36[j] | 2,8 | .311 | .253 |

**p* < .05. ***p* < .01. ****p* < .001.

[a] *N* = 63 distressed patients who received at least one appropriate psychosocial contact.

[b] *N* = 11 distressed patients who received at least one appropriate psychosocial service.

[c] Variable transformed using a square root transformation as original variable was not normally distributed.

[d] Coded as 1 = None, 2 = Medicare and/or Medical (No private insurance), 3 = Private insurance AND Medicare and/or Medical, 4 = Private insurance only.

[e] Levene's and Welch's test unable to be performed due to small sample size. As such, regular ANOVA reported, but a more conservative significance level used (alpha < .01).

[f] Coded as 1 = Breast, 2 = Female genital system, 3 = Male genital system, 4 = Other cancers (subgroup less than or equal to 5), 5 = Urinary system.

[g] Coded as 1 = Community resources coordinators, 2 = Financial counselors, 3 = Social workers.

[h] Variances of populations unequal. Welch's test reported.

[i] Coded as 1 = Financial counselors, 2 = Rehabilitation specialists, 3 = Social workers.

[j] Variances of populations unequal. Welch's test unable to be performed due to small sample size. As such, regular ANOVA reported, but a more conservative significance level used (alpha < .01).

*Table 8.* Logistic Regression Statistics for Model 1[a]

| Patient, clinical, or health system factor | Outcome variable | *B* | *S.E.* | *Wald* | *df* | *p* | *OR* | *95% CI* |
|---|---|---|---|---|---|---|---|---|
| Number of automated notifications that needed follow-up** | Receipt of at least one appropriate psychosocial contact[b] | 0.68 | .23 | 8.75 | 1 | .003 | 1.97 | 1.26-3.08 |

**p* < .05. ***p* < .01. ****p* < .001.

[a] *N* = 103 patients screened and identified as distressed whose SupportScreen generated at least one automated notification that needed follow-up.

[b] Coded as 0 = No, 1 = Yes.

*Table 9.* Cox Regression Statistics for Model 9[a]

| Patient, clinical, or health system factor | Outcome variable | *B* | *S.E.* | *Wald* | *df* | *p* | *OR* | *95% CI* |
|---|---|---|---|---|---|---|---|---|
| Number of automated notifications that needed follow-up | Time to receipt of first appropriate psychosocial contact | 0.09 | .11 | 0.56 | 1 | .455 | 1.09 | 0.87-1.36 |
| Type of first appropriate psychosocial contact[b]*** | Time to receipt of first appropriate psychosocial contact | -1.46 | .37 | 15.41 | 1 | <.001 | 0.23 | 0.11-0.48 |

*$p < .05$. **$p < .01$. ***$p < .001$.

[a] $N = 60$ distressed patients who received at least one appropriate psychosocial contact; sample excluded n = 3 patients with first appropriate psychosocial contact from financial counselors due to small sub-group sample size.

[b] Coded as 1 = social workers and 0 = community resources coordinators.

*Table 10.* Chi-Square Tests Characterizing Dichotomized Patient, Clinical, and Health System Factors and the Outcome Variable Receipt of At Least One Appropriate Psychosocial Service[a]

| Patient, clinical, or health system factor | Receipt of at least one appropriate psychosocial service | | | |
|---|---|---|---|---|
| | $\chi^2$ | *df* | *p* | *OR* |
| Age[b] | 0.02 | 1 | .901 | 0.92 |
| Gender[c] | 0.30 | 1 | .583 | 1.42 |
| Preferred language[d] | 0.21 | 1 | .645 | 1.65 |
| Race/Ethnicity[e] | 0.04 | 1 | .852 | 0.88 |
| Highest level of education[f] | 0.02 | 1 | .882 | 1.13 |
| Insurance status[g] | 2.27 | 1 | .132 | 1.15 |
| Type of cancer[h] | 0.02 | 1 | .882 | 1.10 |
| Number of automated notifications that needed follow-up[i] | 0.69 | 1 | .405 | 1.79 |

$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

[a] *N* = 103 patients screened and identified as distressed whose SupportScreen generated at least one automated notification that needed follow-up.

[b] Coded as 1 = Age 59 or younger, 2 = Age 60 or older (variable split at M age = 60 years).

[c] Coded as 0 = Female, 1 = Male.

[d] Coded as 0 = Other than English, 1 = English.

[e] Coded as 0 = Not from a medically underserved racial/ethnic group, 1 = From a medically underserved racial/ethnic group.

[f] Coded as 0 = High school graduate or less, 1 = Any college education or more.

[g] Coded as 1 = No insurance, 2 = Any type of insurance (i.e., Private insurance, Medical, and/or Medicare).

[h] Coded as 1 = Breast cancer, 2 = Cancer other than breast cancer.

[i] Coded as 1 = 1 or fewer automated notifications that needed follow-up, 2 = 2 or more automated notifications that needed follow-up (variable split at *M* number of automated notifications that needed follow-up = 2).

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