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Published in:
Supportive Care in Cancer

DOI:
10.1007/s00520-018-4252-8

This is a post-peer-review, pre-copyedit version of an article published in 'Supportive Care in Cancer'. The final authenticated version is available online at: https://doi.org/10.1007/s00520-018-4252-8

Utility of Mayo Clinic's Early Screen for Discharge Planning tool for predicting patient length of stay, discharge destination, and readmission risk in an inpatient oncology cohort

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This is a post-peer-review, pre-copyedit version of an article published in 'Supportive Care in Cancer'. The final authenticated version is available online at: https://doi.org/10.1007/s00520-018-4252-8

Abstract

Purpose: To examine the feasibility of using the Mayo Clinic's Early Screen for Discharge Planning (ESDP) tool in determining its predictive ability in an inpatient oncology hospital setting for variables including length of stay (LOS), discharge destination, and readmission risk.

Methods: A prospective observational study was conducted at a metropolitan tertiary cancer centre in Melbourne, Australia. The ESDP score, along with patient outcomes and characteristics, were collected to examine the relationships between positive and negative ESDP scores and patient outcomes.

Results: A total of 136 participants met inclusion criteria for this study. The proportion with positive ESDP scores was greater in those with unplanned hospital admissions compared with planned admissions ($\chi^2(1, n=136) = 3.94, p=0.047$). The ESDP status was not a significant predictor of oncology hospital LOS ($r_{pb}=0.116, p=0.178$), however, the ESDP scores did predict discharge destination ($\chi^2(2, n=136)= 20.22, p<.001$). Those re-admitted within 14 days were more likely to have negative ESDP scores than those not readmitted within this time period ($\chi^2(1, n=136)= 5.22, p=0.022$). Those with positive ESDP scores received a greater number of hospital services whilst admitted than those with negative scores ($r_{pb}=0.388, p<.001$), and were more likely to receive particular types of services.

Conclusion: The findings from this study suggest that the ESDP tool could be useful in an adult inpatient oncology population in a hospital with defined specialised hospital discharge planning services (SHDCPS). The ESDP may be beneficial for early identification of service types likely to be required in care and likely discharge destination, both of which can assist discharge planning (DP), however, the ESDP was not useful for predicting LOS or readmission risk in the adult inpatient oncology population without a SHDCPS model in place.

Key Words: ESDP, discharge planning, oncology, inpatient, patient outcomes

Introduction

Reducing hospital length of stay (LOS) as well as readmission risk is crucial in improving patient care outcomes. Improving these outcomes by improving discharge planning (DP) efficiency has long been the goal of many Australian health services [1-5].

When patients occupy a hospital bed for longer than necessary it is most likely a result of poorly-implemented DP [2]. Approximately one-fifth of all hospital discharges are delayed for non-medical reasons such as complex social needs, preparation of applications for facility placement, and discharge destination planning [6]. The patient's discharge destination plays an important role in increased LOS, as DP for facility placement can require more planning and coordination by hospital staff than a discharge directly home. Furthermore, unplanned hospital readmissions may be due to lack of follow-up with the patient or a lack of communication between the medical team and carer following a discharge from the hospital setting [7]. Failure to practice timely DP results in inadequate care transitions, which in turn, may lead to decreased access to acute hospital beds, reduced capacity to treat higher numbers of patients, and an increase in unnecessary hospital costs [8]. The ever-growing ageing population as well as the increasing incidence of chronic diseases are often attributed to higher numbers of hospital admissions and longer LOS [9], however, inadequate DP has also been shown to play a major role. [10].

Unplanned hospital admissions and increased LOS have created an economic burden on Australia's healthcare system. For example, in 2013-14, $10.5 billion was spent on hospital services and assets in the state of Victoria, Australia—73% of the Department of Health & Human Services' (DHHS) budget [1]. Improving patient outcomes such as hospital LOS and readmission rates could have a significant financial impact allowing funds to be directed to other services [11]. Further contributing to Australia's economic burden are costs associated with cancers. A study on burden of disease in Australia conducted by the Australian Institute of Health and Welfare (AIHW) in 2011 demonstrated that cancer contributes 19% towards the total health burden and was found to be the main burden for individuals aged between 50 and 79 [12]. Additionally, the AIHW published a report stating that cancer and other neoplasms accounted for $4.526 million or 7% of total recurrent health spending in 2008-09 [13].

There have been many recent improvements within the health sector in relation to the development of electronic medical records, patient discharge planning, and decision support tools, however, there remains the potential for improvement when it comes to DP efficiency [1]. The Australian Department of Health (ADH) (2003) has identified three key explanations for current inefficiency in this area: inadequate health professional assessments of patients, late booking of transport to take patients home, and overall poor communication between hospital, follow-up care, and community service providers [14]. Currently, the most relevant tool to aid in efficient DP in an oncology population is the Comprehensive Geriatric Assessment (CGA). It was systematically reviewed by the Task force on CGA of the International Society of Geriatric Oncology, and was found to be useful in screening older oncology patients; however, it had poor generalisability to the inpatient adult oncology population and has not yet been standardised [15-17].

Based on these ongoing gaps in DP services, it has been recommended by the Victorian Auditor-General's Office that public hospitals implement programs with the aim of improving LOS outcomes by increasing DP efficiency [1]. To accomplish the goal of improving hospital DP efficiency, all steps of the DP process must be considered. These include: 1) early identification and assessment, 2) patient and carer collaboration, 3) continuing care option recommendations, 4) liaison with community agencies, and 5) provision of patient support [18]. The first step in improving the DP process is identifying and assessing those patients who will likely need specialised input from specialised hospital discharge planning services (SHDCPS) [19].

The Mayo Clinic's *Early Screen for Discharge Planning* (ESDP) tool has been developed and validated (general medical, surgical, and ICU) to be used in the first step of DP (early identification and assessment) [19] based on factors likely to predict need for referral to SHDCPS. Once the Mayo clinic established SHDCPS, the ESDP tool was implemented into their electronic medical records (EMR) to screen patients upon admission to hospital [8]. Those with positive scores (≥10) are referred to SHDCPS, which includes discharge planning nurse specialists (DPNS) and social workers with clearly defined roles working in the same department [8]. Upon conducting a study to observe the impact of ESDP implementation, the Mayo Clinic observed a 20% reduction in patient LOS following implementation of this screening tool [8,20].

The Peter MacCallum Cancer Centre (PMCC) in Melbourne is a public hospital accepting patients from across Australia, representing a geographically and ethnically diverse patient population. PMCC currently has no SHDCPS or designated DP coordinator. The current unstandardised DP process involves daily allied health morning meetings, involving nurse-in-charge (NIC), dietitian, physiotherapist, occupational therapist, social worker, and a spiritual carer. Allied health referrals are received from this meeting or via the patient referral software, Patient Flow Manager (PFM).

The aim of this study was to examine the feasibility and predictive ability of the ESDP tool in an inpatient population within a metropolitan tertiary oncology hospital (PMCC; 96 beds). Specifically, we aimed to evaluate the utility of the ESDP tool in predicting patient LOS, discharge destination, and readmission rate in a hospital with no currently defined SHDCPS.

Methods

Study design

A prospective cohort study design was employed. This study was approved by the PMCC Ethics Committee (LNR/16/PMCC/189) as well as the Bond University Human Research Ethics Committee (Protocol 15919).

Patient cohort

Data from clinical records of adult patients who were admitted to PMCC between January and March 2017 were included in this study. The data extracted from clinical records are discussed below. All patients had a diagnosis of cancer in at least one tumour stream (lung, bone & soft tissue, skin, head & neck, haematology, breast, neurology, gynaecology, urology, gastrointestinal, hepatobiliary, or colorectal). Those patients whose estimated time and date of discharge (EDD) was less than 72 hours after admission were excluded from the study; however, those patients without an EDD were included. Consent for use of patient data for research is obtained as a standard part of the patient admission process at PMCC.

ESDP tool

Mayo Clinic's ESDP tool is a four-question screening tool (age, prior living status, Rankin disability score, and self-reported walking limitation) that was developed and validated (sensitivity 75%, specificity 78%) by Holland et al. (2006) in acute medical, surgical, and intensive care units in a large tertiary hospital in Midwestern USA [19]. The tool provides a score between 0 and 23 and aids in identifying those patients early in their hospital stay who require a referral to SHDCPS. A positive score (≥10) was found to indicate the need

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for automatic referral to SHDCPS for complex DP [19]. The self-reported walking limitation portion of the ESDP tool was completed by asking the patient directly, "do you have any problems with your walking?" and recorded as either "yes" or "no."

Procedures
The ESDP tool was completed by a member of the research team by reviewing patient charts and interviewing patients within 72 hours of their hospital admission. Data elements collected and recorded include: age, sex, tumour stream, reason for admission, ESDP score, LOS, readmission status at 14 and 28 days post-discharge, inpatient treatment, allied health care types received, and discharge destination. All ESDP scores were blinded to all clinicians in charge of care. Only researchers had access to patient scores. As PMCC had no defined SHDCPS at the time of the study, the scores were not used to refer patients for SHDCPS, but were used solely for observation of data correlations. Given the heterogeneity of discharge destinations, the destinations were grouped into three categories based on levels of attendant care: 1) home and community living; 2) sub-acute facility (such as rehabilitation or Geriatric Evaluation and Management [GEM] units), inpatient palliative care (IPPC), and residential care; and 3) acute local hospital. ESDP scores that were at or above the cut-off score (≥10) were considered positive scores and those below a score of 10 were considered negative scores.

Statistical analyses
All collected data were entered into a secure research database, REDCap (Vanderbilt University, 2009, version 7.6.7), accessible only to four research investigators located at PMCC (C.S., S.P., L.B., E.K.) [21]. Data were cleaned and de-identified before analysis. All statistical analyses were performed using IBM SPSS software (Version 24, 2016). Descriptive statistics were used to summarise the data, with normally distributed variables reported as mean ± standard deviation (SD) and non-normally distributed variables reported as median and interquartile range (IQR). Differences between admitting wards in average patient age, hospital LOS, treatment types received (chemotherapy and radiotherapy), and number of hospital services used were examined using the Kruskal-Wallis independent samples test. Relationships between dichotomous ESDP scores (<10 or ≥ 10), clinical characteristics, and patient outcomes were examined using chi-square tests, for categorical variables, or point biserial correlation coefficients, for continuous variables. All tests were 2-sided, with alpha set at 0.05. To assess variables that were predictive of hospital LOS and discharge destination or hospital re-admission, linear and logistic regression models were used, respectively. Demographic and clinical variables associated with the outcome of interest, without evidence of collinearity, were entered into the models based on strength of association with the outcome of interest.

Results

Sample characteristics
A total of 136 patients met eligibility criteria for the study, with a median (IQR) age of 63 (50-70.5) years. Males comprised 55.9% (n = 76) of the study participants. Forty-eight percent (n = 65) of the sample had positive ESDP scores at hospital admission. A total of 71.3% (n = 97) of participants were admitted under the medical team. The most common tumour streams in which participants were admitted by the medical team were as follows: 42.3% haematology, 13.4% lung, 11.3% gastrointestinal, 8.2% skin and 7.2% bone & soft tissue. Among those patients admitted under surgical teams (28.7%), the most common tumour streams were: 35.9% colorectal, 20.5% skin, and 12.8% bone & soft tissue. No statistically significant differences were found between cohorts of patients from the general medical, haematology, and surgical wards in age (p=0.667), LOS (p=0.461), number of services used (p=0.343), or ESDP score (p=0.166).The majority of patients were admitted from home (63.2%) or from an acute hospital (29.4%). The median (IQR) hospital LOS of participants was 7 (4-13) days. **Table 1** provides an overview of relevant participant characteristics.

A greater proportion of males (41/76; 54%) than females (24/60; 40%) had positive ESDP scores, however this difference was not statistically significant ($\chi^2(1, n=136)= 2.61, p=0.106$). A large percentage of admissions (57.4%) were unplanned and a greater proportion of these patients had positive ESDP scores, when compared to patients with planned admissions ($\chi^2(1, n=136)= 3.94, p=0.047$). **Table 2** presents an overview of age distributions and proportions of participants with a positive ESDP score by patient gender and admission type.

ESDP scores, hospital LOS, discharge destination, and readmission rates.
Hospital LOS was not significantly associated with category of ESDP score (positive or negative; $r_{pb}=0.116$, $p=0.178$). Participants with positive ESDP scores were not more likely than those with negative ESDP scores to have an increased LOS above that for their diagnosis-related group (DRG ($\chi^2(1, n=133)=1.38, p=0.241$).

Across the total sample of participants, 85.3% were discharged home, to a family or friend's home, or to PMCC patient apartments; a further 11.8% were discharged to a sub-acute facility (rehab or GEM), IPPC, residential care, or received end of life care at PMCC; and 2.9% were discharged to an acute local hospital. There were significant differences between discharge destinations in participants with positive ESDP scores; those discharged to sub-acute, IPPC, or residential care were more likely to have positive scores than those discharged to other destinations (χ^2(1, n=136)= 20.22, p<.001).

The overall 14- and 28-day readmission rates were 20.6% and 11% of patients, respectively. Those with negative ESDP scores were more likely to be re-admitted within 14 days (χ^2(1, n-136)= 5.22, p=0.022). There was no significant association between ESDP score and 28-day readmission status (χ^2(1, n=136)=1.41, p=0.235).

ESDP scores and numbers of services, types of hospital services, and treatment types received
The median (IQR) number of health care types provided to participants during their hospital stay was 3 (1-5). ESDP score status (positive or negative) was significantly and positively correlated with the number of services involved in their inpatient care (r_{pb}=0.388, p<.001) and was also associated with whether or not particular service types were involved in a patient's care in the inpatient setting. Positive ESDP scores were associated with higher likelihoods of receiving physiotherapy (χ^2(1, n=136)=25.17, p<0.001), occupational therapy (χ^2(1, n=136)=19.59, p<0.001), social work (χ^2(1, n=136)=20.04, p<0.001), and pain and palliative care (χ^2(1, n=136) =9.60, p=.002) services, but lower likelihoods of receiving chemotherapy treatment (χ^2(1, n=136)=10.03, p=0.002). Physiotherapy was the most utilised allied health service, followed by dietetics, social work, pain & palliative care, and occupational therapy.

Predictors of hospital LOS, discharge destination, and re-admission
The number of inpatient services received was the only variable significantly associated with LOS, and retained significance when entered into the regression model, accounting for 27.8% of the variance in LOS.

Whether patients were discharged to home or community living versus acute, sub-acute, IPPC, or residential care facilities was significantly predicted by the full model (**Table 3**), χ^2 (4, n=133) = 26.26, p<0.001, indicating the model was able to distinguish between these discharge destinations. The model as a whole explained between 17.9% (Cox and Snell R square) and 32% (Nagelkerke R Square) of the variance in discharge destination and correctly classified 87.2% of cases. Only three independent variables made a unique statistically significant contribution to the model for predicting discharge destination (ESDP, LOS above the average for DRG, and whether or not the participant received pain & palliative care services; **Table 3**). Those with positive ESDP scores were 5.3 times more likely to be discharged to destinations other than home or community living, compared to those with negative ESDP scores. Those with positive scores were more likely to be discharged to a destination that provided a higher level of care.

Variables significantly associated with 14-day readmission included age, use of dietitian services, ESDP score, and number of services used. The full predictive model to distinguish between those who were and were not re-admitted within 14 days of hospital discharge (**Table 4**) reached significance, χ^2 (4, n=135) = 14.11, p=0.007. This model explained between 9.9% (Cox and Snell R square) and 15.5% (Nagelkerke R Square) of the variance in discharge destination and correctly classified 81.5% of cases. Only age made a unique statistically significant contribution to the model (see **Table 4**). For each additional year of age, the odds of readmission reduced by 3%, and older participants were less likely to be readmitted within 14 days of discharge than their younger counterparts.

Discussion

This is the first study to our knowledge that has evaluated the utility of Mayo Clinic's ESDP tool in a metropolitan inpatient oncology population. Interestingly, ESDP scores were not found to be significantly correlated with hospital LOS. Patients with a positive ESDP scores were not more likely to require a longer stay in hospital than those with negative ESDP scores. The reason for this result may be because LOS in an oncology setting is affected by the requirements of surgery or other treatments, including chemotherapy and radiotherapy, which may be planned for a certain length of stays [22]. Our study population differs from that of the population in which the ESDP tool was validated in (general medical, surgical, and ICU settings), which may further explain our findings [8]. Because some of these treatments are elective, patients with negative ESDP scores may have an extended LOS in hospital, and this may explain the lack of association with positive ESDP scores. In addition, some of those patients with positive ESDP scores may be deemed unsuitable to receive some forms of elective treatment, and they may also receive adequate care in a residential aged care facility or other facility and so not require a longer hospital LOS. Our finding of an association between the number of inpatient services received and LOS may simply be explained by the fact that those with a prolonged admission may be likely to receive more services than those who are admitted for a shorter period.

Our study found ESDP scores to be significantly associated with 14-day readmission status. Patients with negative ESDP scores were more likely to be readmitted within 14 days of discharge than those with positive ESDP scores. This finding may be explained by the fact that readmissions in the oncology setting are frequently planned for further treatment or to receive treatment that is unavailable in the usual location in which the patient lives. ESDP scores were not found to be associated with 28-day readmission status.

We found a significant relationship between ESDP scores and discharge destinations. Patients discharged to a sub-acute facility, IPPC, or residential care group were more likely to have a positive ESDP score than patients discharged to other discharge destinations (home and community living or acute local hospital). Positive ESDP scores indicate a greater complexity of DP needs. Discharge destinations such as sub-acute facilities (rehab or GEM), IPPC, and residential care facilities are usually well-equipped to accept patients who have complex post-acute care (PAC) needs and who are not appropriate for discharge to home [23]. Our analysis of factors predicting discharge destination was likely affected by the fact that prior living arrangement contributes to the ESDP score, therefore explaining a proportion of its observed relationship with discharge destination, as those admitted from a residential care facility are more likely to be discharged back to the same facility.

This study demonstrated that ESDP scores were significantly and positively associated with the numbers and types of services involved in inpatient care. In relation to hospital service types received, ESDP scores were positively associated with receiving physiotherapy, occupational therapy, social work, dietetics, and pain & palliative care services. These relationships make sense, as patients who receive allied health input such as physiotherapy or occupational therapy typically have an existing functional limitation that acts as a barrier to discharge, warranting a referral to allied health services. Physiotherapy was the most utilised hospital service type, followed by dietetics, social work, pain & palliative care, and occupational therapy, signifying the important role that each of these allied health professions plays in patient care and the DP process. Our findings also demonstrated that ESDP scores were significantly but negatively correlated with patients receiving chemotherapy treatment. One hypothesis for this finding could be that the majority of patients admitted for chemotherapy had planned inpatient treatment admissions and were, therefore, less likely to be requiring complex DP. In addition, those with positive ESDP scores may have been too unwell to qualify for chemotherapy. Planned hospital admissions were associated with negative ESDP scores, and those patients whose admission to hospital was unplanned were more likely to have positive ESDP scores.

The limitations of this study should be noted. Firstly, the period of patient screening and enrolment in the study was limited to six weeks. Secondly, a large number of potential participants were excluded from the study as their EDD was less than 72 hours. Some of these patients had an inpatient stay greater than 72 hours, however, they were unable to be included in the study as the ESDP needed to be administered within the first 72 hours of admission, as per our inclusion criteria. More lenient inclusion criteria regarding the EDD may have resulted in more of these participants being included in the study and this should be considered in further research. Thirdly, our study involved a relatively small sample and was limited to one Australian hospital site. Further research involving larger sample sizes and a variety of hospital contexts would be valuable. Lastly, we acknowledge that there are clearly several factors which contribute to discharge destination. We also acknowledge the limitations of our work in that only a small proportion of our sample (11%) were discharged to sub-acute facilities.

There are several strengths of the study worth mentioning. Ultimately, our prospective study, the first to examine the utility of the ESDP tool in an acute oncology setting, showed that the ESDP can assist in early identification of those patients requiring particular service types during their inpatient stay. The tool was also of moderate utility to identify those patients who were discharged to subacute, IPPC, or residential care. Finally, a variety of clinicians within our multi-disciplinary team found Mayo Clinic's ESDP tool to be easy to use in the oncology clinical setting.

Conclusion

The current study is the first to examine the utility and predictive validity of a DP tool in the inpatient cancer care setting. The findings from this study suggest that the ESDP tool is useful in an adult inpatient oncology population for early identification of service types likely to be required whilst an inpatient as well as likely discharge destination, both of which can assist DP. With regards to the prediction of LOS and hospital re-admission risks, factors other than those assessed by the ESDP clearly played a significant role in this context and the ESDP was not identified as a useful tool for predicting these outcomes within the adult inpatient oncology population.

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Our study focus was to capture PMCC specific data in hopes of ultimately developing SHDCPS in which to implement the ESDP tool in subsequent studies. It is recommended that further research focuses on the implementation of the ESDP tool in a range of acute inpatient oncology settings with a defined SHDCPS, in order to validate the tool in the oncology setting. In addition, a focus should be placed on identifying factors other than ESDP scores that may predict or affect LOS and hospital re-admissions in this setting. In any such investigation of a broader range of factors, it may be of benefit to consider hospital expenditures associated with patient outcomes such as LOS, readmission rate, discharge destination, and numbers of service types involved in care. Finally, a focus on PAC needs in the oncology context rather than in the general medical, surgical, and intensive care contexts would add value to the DP process.

Improving patient outcomes and the burden on hospitals through efficient DP is a goal for which many clinicians strive. Early identification of those patients requiring a timely referral to meet complex PAC needs is essential to ensure an efficient DP process.

Conflict of Interest

The authors of this research manuscript have no conflicts of interests. The authors maintain full control of all primary data and is available upon request.

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