

**Patterns of health services utilization in the last 2 weeks of life among cancer patients: experience in an Australian academic cancer centre**

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**Patterns of health services utilization in the last 2 weeks of life among cancer patients: experience in an Australian academic cancer centre**

#### **ABSTRACT**

**Aim:** To report on the trend in end of life health services (HS) utilization among cancer patients treated in a large Australian academic cancer centre over a twelve-year period

**Methods:** This is a retrospective study of cancer patients treated at the Peter MacCallum Cancer Centre (PMCC), who had documented death between 1/1/2002 and 31/12/2013. Using administrative and billing database, we report on the utilization of different categories of HS within 2 weeks of death: diagnostic investigation (pathology and radiology), inpatient and outpatient services, and potentially futile intervention (PFI, which include radiotherapy, chemotherapy and surgery).

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**Results:** Of the 27,926 'active' cancer patients in the study (i.e. those with medical contact at PMCC in the last year of life), 6,368 (23%) had documented HS utilization within 2 weeks of death. 11% and 9% had pathology and radiology investigations respectively, 14% had outpatient clinic appointments, and 7% had hospital admissions. There were 2,654 patients (10%) who had PFI within 2 weeks of death – 2,198 (8%) had radiotherapy, 287 (1%) chemotherapy and 267 (1%) surgery. We observed peak HS and PFI utilization in 2004, which then dropped to its lowest in 2009/2010.

**Conclusion:** Experience in an Australian cancer centre suggests approximately one in four 'active' cancer patients had HS utilization, and one in ten had PFI, within two weeks of death. The implementation of palliative care guidelines may reduce some of these potentially wasteful and futile interventions.

**Keywords:** end of life care, health services, palliative care, potentially futile intervention

## INTRODUCTION

Along with the advances in cancer treatment options over the years, there is a corresponding increased trend towards more aggressive end of life (EOL) care for cancer patients (1). Aggressive EOL cancer care can take many forms including active cancer treatment (surgery, radiotherapy or systemic therapy), outpatient clinic follow-up and hospital admission, as well as potentially invasive diagnostic and pathological investigations. These hospital-centric activities often consume valuable time in patients who already have limited life expectancy (2, 3), and involve significant healthcare cost.

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The trend towards more aggressive EOL care has been observed in multiple countries. In a population-based study using the US Surveillance, Epidemiology, and End Results (SEER) database involving nearly 30,000 patients, Earle et al reported increasing utilization of chemotherapy, emergency department (ED) visit, hospitalization and intensive care unit (ICU) admission in the last 2-4 weeks of life from 1993 to 1996 (1). In a separate population-based study in Canada using the Ontario Cancer Registry data, Ho et al reported significant increases in multiple ED visits, ICU admissions and utilization of chemotherapy within 30 days of death from 1993 to 2004 (4). In a more recent study of colorectal cancer patients in the Alberta Cancer Registry, Canada from 2006 to 2009, it was reported that half of the patients died in acute hospital setting, which is another indicator of aggressive EOL care (5). Overall, aggressive EOL cancer care reflects poor quality of care. High rates of unplanned ED visits or hospital admissions at the EOL for example may suggest suboptimal EOL symptom management as well as lack of outpatient palliative care utilization. Chemotherapy in the last week of life, on the other hand, may offer little clinical benefits, but may lead to toxicities requiring hospital admissions (6, 7).

Aggressive EOL care also has huge implications on healthcare cost, leading to a disproportionate share of healthcare costs concentrated towards the EOL in cancer patients. In a US study of approximately 30,000 commercially insured cancer patients who died between 2002 and 2009, Chastek et al reported that more than 50% of health care cost in the last 6 months of life were attributed to acute inpatient care, and this increased from just under 2,000 dollars in the 6<sup>th</sup> month before death to over 20,000 dollars in the final month before death (8). In a separate population-based study of cancer patients who died in Ontario, Canada between 2005 and 2009, Cheung et al reported that patients who receive aggressive EOL cancer care incur 43% higher healthcare cost than those managed non-aggressively (9).

To date, however, there have been very little data exploring and describing health services (HS) utilization at the EOL among cancer patients using Australian data. The aim of this study is to report on pattern of EOL care in cancer patients based on our experience in a major academic cancer centre in Victoria, Australia. Specifically, we aim to describe HS utilization and potentially futile interventions (PFI) in the last 2 weeks of life among cancer patients.

## **METHODS**

### ***Study design:***

This is a single institution retrospective study performed at the Peter MacCallum Cancer Centre (PMCC), a quaternary cancer institution in the state of Victoria, Australia. PMCC operates a metropolitan hospital with inpatient beds for each of the medical, radiation and surgical oncology unit, as well as intensive care unit. There are no palliative care inpatient beds, but the palliative care services are available for consults for other inpatient units and also run specialist outpatient clinics. In addition, during the study period, PMCC also operated three radiation oncology satellite sites – two metropolitan and one regional centres – which are primarily outpatient services. Of all cancer patients treated with at PMCC with documented date of death from 1/1/2002 to 31/12/2013, only ‘active’ cancer patients (i.e. those with documented medical contacts/ HS utilizations at PMCC in the final year of life) were included in the final study cohort, in order to truly reflect the practice of EOL cancer care at PMCC. The study was approved by the PMCC Human Research Ethics Committee.

***Data source:*** Data were extracted from the administrative and billing database. The HS categories of interest were: diagnostic investigations (pathology and radiology), inpatient and outpatient services, as well as treatments (radiotherapy, chemotherapy and surgery). We acknowledge that not all treatments in the last 2 weeks of life are necessarily futile (e.g. patients with unexpected death from non-cancer related causes), while at the same time

some treatments may have actually contributed to patients' death (e.g. neutropenic sepsis from chemotherapy)(10). However, due to the impracticability of individual patient medical chart review, any treatment in the last 2 weeks of life is considered PFI for the study purpose.

**Statistical analyses:** Descriptive statistics were used to analyse the data. For categorical variables, data were described as count and percentage.

## RESULTS

There were 27,926 patients included in the current study. Of these, approximately one quarter (6,368/ 27,296) had documented HS utilization in the last 2 weeks of life. Compared to those with no HS utilization, patients who had documented HS utilization in the last 2 weeks of life were more likely to be male and younger (TABLE-1).

Of the 27,926 patients, 3,186 (11%) patients had a total of 60,161 *pathology investigations* done in the last 2 week of life (TABLE-2, TABLE-3). While the majority of the pathology investigations were routine blood tests, such as biochemistry (46%), haematology (27%) and coagulation profiles (12%), there were also potentially invasive pathology investigations performed, including 157 (0.3%) bone marrow aspirate and trephine biopsies (TABLE-3). There were also 5,132 (9%) episodes of pathology tests involving the blood bank (i.e. cross match).

There were 9% of patients (2,494/ 27,926) who had a total of 8,243 *radiology investigations* within 2 weeks of death, of which majority of the investigations (5252/ 8243, 62%) were X-ray imaging (TABLE-3). However, there were also utilizations of other high cost imaging, including 263 MRI scans (3%) and 156 PET scans (2%) (TABLE-3). Seven percent of patients (1,929/ 27,926) had 2,264 episodes of *hospital admissions*. *Outpatient clinic* visits is the most commonly utilized HS, with as many as 14% of the patients (3,812/ 27,926) having attended a total of 7,649 clinic appointment in the last 2 weeks of life.

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Approximately one in ten patients in the cohort (2,654/ 27,926) had documented *PFI* utilization within 2 weeks of death (TABLE-2). Of the *PFI*, *radiotherapy* was the most commonly utilized treatment modality: 83% of the patients who had *PFI* (n=2,198/ 2,654) received a total of 7,939 fractions of radiotherapy (TABLE-4). And of the patients who had radiotherapy, approximately 10% (213/ 2,198) were still receiving treatment with radical intent within 2 weeks of death (TABLE-4). The remaining 1,996 patients who had palliative radiotherapy had a total of 6,898 fractions of radiotherapy, averaging 3.5 fractions per patient in the last 2 weeks of death.

Surgery and chemotherapy were less commonly utilized *PFI*, with 1% of the patients reported to have had surgery (267/ 27,926) and chemotherapy (187/ 27,926) in the last 2 weeks of life respectively (TABLE-4). There were a total of 299 surgical procedures (including endoscopic procedures) performed in the 267 patients within 2 weeks of death, and 83% (250/299) were elective procedures.

Over the 12-year study period, we observed a spike in utilization for all HS categories in 2004 (FIGURE-1) – 440 of the 1,221 patients (36%) had documented HS utilization within 2 weeks of death in that year (TABLE-2). Thereafter, overall HS utilization dropped to its lowest in 2009 and 2010, with less than one in five patients having documented HS utilization for each calendar year (TABLE-2). There appeared to be a rise in numbers in most HS categories from 2011 onwards, except for chemotherapy and surgery, which remained relatively stable (approximately 1%) over that period of time.

## **DISCUSSION**

There is an increasing trend in more aggressive EOL cancer care reported in the literature worldwide (1, 4, 5). Here, we report on the EOL HS utilization, including *PFI*, among cancer patients treated at our institution over a 12-year period. We observed approximately one in four cancer patients utilizing HS, and one in ten receiving *PFI* within 2 weeks of death.

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There are several limitations to take into consideration when interpreting the results of the current study. Firstly, this is a single institution retrospective study based on administrative and billing database. We recognize the potential inaccuracy in the database, which was not primarily collected for the purpose of the current health service research. One aspect to highlight is the wide range of number of 'active' cancer patients included in the study for each calendar year, ranging from 1,221 patients in 2004 to 3,069 patients in 2010.

Therefore, we believe that not all eligible 'active' cancer patients (denominator) have been accurately captured in the database. This is the most likely reason for the inexplicable spike in *proportion* of patients who had HS utilization in 2004 despite the relatively stable *number* of patients (numerator) who had HS utilization in 2004. Another likely reason for the spike is the change in administrative coding process over that period. Also, we could not discount the possibility of misclassification of HS utilization (either under or over-reporting).

Secondly, the study cohort only comprised 'active' cancer patients who had medical contacts (i.e. any HS utilization) at our institution in the final year of life. Inclusion of all 'active' and 'inactive' (i.e. those with *no* medical contact or any HS utilization at our institution in the final year of life) cancer patients, we believe, would definitely lead to a lower proportion of reported HS utilization and PFI (given a larger denominator), but that is not a true reflection of the practice of the EOL cancer care at our institution. It is also important to bear in mind that, our observation in a public academic cancer centre may not necessarily reflect the practice in the general population, such as regional cancer centres, community palliative care settings or private healthcare sectors. Previous studies have shown that patients in community palliative care settings are less likely to have aggressive EOL care (11), and likewise those in private healthcare sectors are more likely to receive aggressive EOL care (12).

When stratified by categories of HS utilization, we observed approximately one in ten patients having ***pathology and radiology investigations*** within 2 weeks of death. it is

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important to acknowledge the likely under-reporting of diagnostic investigations utilization at the EOL among our cohort of patients, as we could not discount the possibility of patients having these investigations done at external pathology and radiology services. Nonetheless, earlier studies have reported relatively common utilization of diagnostic investigations at the EOL cancer care (13-15). A study 39 patients with haematological malignancies in a single institution in Hong Kong reported as many as four in five patients having blood tests done in the final week of life (14). In a larger study in the Vancouver Cancer Centre, a tertiary cancer centre in Canada, Hui et al reported that, of the 118 patients who died in hospital between 2005 and 2006, an average of two investigations (either pathology or radiology) per day were done for every admitted day (15). The same study also reported that 91% and 28% of patients had investigations done in the last week and last day of life respectively.

To our knowledge, there is no guidelines as to how many investigations is considered inappropriate towards the EOL. While avoiding unnecessary investigations towards the EOL is desirable, certain investigations may be useful in improving quality of care and patients' quality of EOL. For example, pathology investigations may be required for patients who may benefit from blood product transfusion (16). In our study, we reported more than 5,000 pathology investigations involving the blood bank (such as cross-match) within 2 weeks of death. There was, however, insufficient information in our study to ascertain if these patients actually received blood transfusion. On the other hand, decision on blood product transfusion at the EOL itself is challenging and controversial, but can still be useful in certain situations (17). In another study in Vancouver Cancer Centre, Hui et al investigated the appropriateness of investigations at the EOL of cancer care based on proportion of investigations for which there were clear indications, by reviewing patients' progress notes (15). Acknowledging the subjectivity in interpretation of what constitute appropriate investigation, it was reported that in 40% of patients, >80% of investigations were considered appropriately. It was also reported that blood tests such as full blood examination

and electrolytes were ordered with less discretion, while radiological investigations were often performed appropriately (15).

**Outpatient clinic** service is reported to be the most commonly utilized HS in our study, with 14% of patients having outpatient appointments in the last 2 weeks of life. While we do not have sufficient information in the database to categorize the outpatient clinic services by subspecialty, we believe that the majority of outpatient services reported in our cohort involve palliative care services, given that the palliative care services in our institutions are primarily outpatient-based services. Earlier study by Temel et al has shown that early palliative care involvement is associated with less aggressive EOL care but longer survival (18). In fact, in a retrospective study at the MD Anderson Cancer Centre, of the 366 patients who died of advanced cancer, approximately half were first seen by the palliative care unit as outpatients, and those who were first seen in outpatient settings were less likely to receive aggressive EOL care, compared to those who had first contact with palliative care services in inpatient settings (19). It is, however, unclear as to the implications of having more or less outpatient clinics in the last 2 weeks of life – attendance at palliative care outpatient clinics for symptom management, for example, may be beneficial in achieving better pain control (20), and potentially avoid unnecessary hospital admissions for pain crisis.

We also report that less than one in ten patients had **hospital admissions** in the last 2 weeks of life, with some having more than one admission. In a population-based study of over 6,000 metastatic non-small cell lung cancer patients in Australia, Philip et al reported 18% of patients, who survived beyond their first hospital admissions, had >1 hospital admissions in their last month of life, and more than half of these patients spent half of their last month of life in hospitals (3). In another population-based study in Canada, Ho et al reported that approximately 8% of patients had >1 hospital admission in the last month of life (4). While our findings on EOL hospital admissions are comparable to earlier studies, it has

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been suggested that >1 hospital admission in the last month of life is an indicator of aggressive EOL cancer care (1, 4), and should be avoided.

While **radiotherapy** is an effective treatment modality for management of pain associated with advanced cancer, it is unlikely to be effective if delivered too close to the EOL. The median time to maximum response to palliative radiotherapy was reported to be 3 weeks (21), and at 2 weeks post completion of palliative radiotherapy less than half of patients are likely to have partial response, and less than a quarter would have complete response (22). In our study cohort, approximately 8% of patients received potentially futile radiotherapy in the last 2 weeks of life, which is comparable to that reported in the SEER-Medicare linked population-based study (23). In a separate population-based study in Norway, it was reported that 8% and 4% cancer patients received palliative radiotherapy within 4 and 2 weeks of death (24). In our study, we also observed that patients received an average of 3-4 fractions radiotherapy in the last 2 weeks of life. Evidence to date suggests that single fraction and multiple fraction radiotherapy regimens provide equivalent symptom control (25, 26), and hence, effort should be put into encouraging single fraction palliative radiotherapy towards the EOL.

Likewise, **chemotherapy** given close to the EOL is also unlikely to provide quality of life benefits, and any chemotherapy given within 2 weeks of death is also an indicator of aggressive EOL cancer care (27). This group of patients are also more likely to be admitted to the hospital at the EOL (6). In a study in New South Wales (NSW) of 749 cancer patients who died between 2005 and 2007, 18% and 8% of the patients received chemotherapy within 4 and 2 weeks of death (28). In a more recent study in regional cancer centres in NSW, of the 1131 patients who received palliative chemotherapy between 2009 and 2011, 12% of the patients died within 30 days of receiving chemotherapy (29). In our cohort, we reported only 1% who had chemotherapy within 2 weeks of death, which appeared lower than most reported literature, ranging from 5-20% of patients (1, 4, 13, 24, 28, 29). One likely

explanation for the much lower utilization of chemotherapy in our study is due to the inherently unique structure of our institution. In addition to the PMCC main campus, which provides all oncology services (surgical, medical and radiation), PMCC also operates three radiation oncology satellite sites. Any surgery or chemotherapy received by patients in the satellite sites would be administered through the non-PMCC surgical or medical oncology unit; hence the PMCC administrative and billing database would not have captured these PFI.

It is also important to bear in mind the difficulty in defining individual patients' illness trajectory at the EOL, in the evaluation of HS utilization and PFI in the last 2 weeks of life of cancer patients. Clinicians have the tendency to over-estimate patients' survival at the EOL, which may often lead to recommendations for potentially unnecessary HS utilization and PFI. In a systematic review of over 1,500 terminally ill cancer patients, Glare et al reported that only one quarter of clinicians' prediction of survival matched the actual survival within a week, and another quarter actually over-estimated survival by at least 4 weeks (30). In a more recent Radiation Therapy Oncology Group (RTOG) trial involving patients with metastatic breast and prostate cancer, Hartsell et al reported that clinicians' prediction of patients' survival was optimistic, compared to actual survival, by an average of 3 months (31). However, the administrative database lacks the granularity to scrutinize the appropriateness of each categories of HS utilization in our study cohort, or to evaluate if the treatment provided benefits the patient. The easy accessibility to HS in an academic cancer centres, such as our institution, may also influence HS utilization in our cohort of patients. In fact, Earle et al have previously reported that receiving care in teaching hospital (or simply living in area with more teaching hospitals) appears to predispose to more aggressive EOL cancer care (27).

It is also not possible to determine if the HS utilization and PFI reflects clinicians' attitudes, or patients' and families' preference. Some patients may request aggressive EOL as they may

feel that doing something (or anything) is better than doing nothing, probably due to a lack of understanding of the true disease prognosis (32). The guidelines by the Palliative Care Australia primarily centred around patients' involvement in decision-making process (33). It is therefore important to have the disease prognosis and the goal of care at the EOL discussed and clearly defined in consultation between the patients, families, and treating team, and the philosophy should reflect the care delivered (including investigations and interventions). With an advanced directive care plan in place, aggressive EOL cancer care can potentially be minimized. A recent study by Wright et al among 1146 family members of patients who died from cancer showed that most family members tend to associate less aggressive EOL care with the perceptions of better EOL care (34).

## **CONCLUSION**

In summary, based on our experience in a large academic cancer centre, we observed that in the last 2 weeks of life, approximately one in four and one in ten 'active' cancer patients had HS utilization and PFI respectively. It is important to acknowledge that while aggressive EOL cancer care should be minimized, some of the HS utilization at the EOL may be beneficial for patients at the EOL. Future studies are warranted to identify patient groups who are likely to benefit from certain HS utilization and interventions without sacrificing excellent EOL cancer care. The implementation of institutional guidelines, and early palliative care referral, is also recommended in order to reduce some of the wasteful and potentially futile interventions.

## **DISCLOSURE**

The authors have stated that they have no conflict of interest.

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**TABLE 1 | Baseline characteristics of the study cohort**

	Patients <u>without</u> HS utilization in the last 2 weeks of life	Patients <u>with</u> HS utilization in the last 2 weeks of life	Total
Number	21,558	6,368	27,926
Age			
0-19	231 (1.1%)	50 (0.8%)	281 (1%)
20-39	556 (2.6%)	265 (4.2%)	821 (2.9%)
40-59	4,027 (19%)	1,553 (24%)	5,580 (20%)
60-79	11,036 (51%)	3,359 (53%)	14,395 (52%)
80+	5,708 (26%)	1141 (18%)	6,849 (26%)
Sex			
Male	12,412 (58%)	3,914 (62%)	16,326 (58%)
Female	9,146 (42%)	2,454 (38%)	11,600 (42%)

\*HS=Health services

**TABLE-2 | Number and proportion of patients who reported health services utilization in the last 2 weeks of life, from 2002 -2013, n (%)**

	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Number of patients in the cohort (i.e. 'active' cancer patients)</b>	<b>1,902</b>	<b>1,788</b>	<b>1,221</b>	<b>1,935</b>	<b>2,270</b>	<b>2,731</b>	<b>2,730</b>	<b>2,857</b>	<b>3,069</b>
<b>Investigations</b>									
Pathology	140 (7%)	265 (15%)	244 (20%)	149 (13%)	260 (12%)	309 (11%)	310 (11%)	274 (10%)	280 (9%)
Radiology	216 (11%)	207 (12%)	189 (16%)	204 (11%)	214 (9%)	227 (8%)	213 (8%)	175 (6%)	222 (7%)
<b>Inpatient/ Outpatient services</b>									
Inpatient	172 (9%)	166 (9%)	164 (13%)	163 (8%)	161 (7%)	177 (7%)	177 (7%)	141 (5%)	165 (5%)
Outpatient	288 (15%)	281 (16%)	302 (25%)	289 (15%)	331 (15%)	357 (13%)	330 (12%)	304 (11%)	312 (10%)
<b>Treatments</b>									

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Radiotherapy	186 (10%)	184 (10%)	151 (12%)	167 (9%)	209 (9%)	199 (7%)	214 (8%)	171 (6%)	197 (6%)
Chemotherapy	13 (0.7%)	14 (0.8%)	29 (2.4%)	25 (1.3%)	18 (0.8%)	27 (1.0%)	32 (1.2%)	27 (0.9%)	25 (0.8%)
Surgery	14 (0.7%)	19 (1.1%)	23 (1.9%)	19 (1.0%)	25 (1.1%)	33 (1.2%)	19 (0.7%)	13 (0.5%)	29 (0.9%)
PFI*	210 (11%)	207 (12%)	195 (16%)	107 (11%)	243 (11%)	250 (9%)	250 (9%)	204 (7%)	245 (8%)
<b>Any health services</b>	461 (24%)	471 (26%)	440 (36%)	482 (25%)	540 (24%)	600 (22%)	603 (22%)	537 (19%)	569 (19%)

\*PFI= potentially futile intervention (including radiotherapy, chemotherapy and surgery)

**TABLE-3 | Pathology and radiological investigations performed in the last 2 weeks of life, from 2002 -2013**

<b>Investigations</b>	<b>Number of patients</b>	<b>Number of investigations</b>
<b>Pathology</b>		
Biochemistry	2,972	27,968 (46.5%)
Haematology	2,811	16,143 (26.8%)
Coagulation	1,923	7,469 (12.4%)
Microbiology	274	1,323 (2.2%)
Viral serology	452	881 (1.5%)
Histopathology	291	318 (0.5%)
Cytopathology	322	382 (0.6%)
Bone marrow aspirate/ trephine	120	157 (0.3%)
Blood bank	1,373	5,132 (85%)
Others <sup>1</sup>	267	388 (0.6%)
<b>TOTAL</b>	<b>3,186</b>	<b>60,161 (100%)</b>
<b>Radiology</b>		

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X-ray (including mammogram)	1,923	5,151 (62.5%)
Ultrasound	686	860 (10.4%)
Angiography	277	359 (4.4%)
CT	1,046	1,249 (15.2%)
Nuclear medicine	186	205 (2.5%)
MRI	250	263 (3.2%)
PET scan	153	156 (1.9%)
TOTAL	2,494	8,243 (100%)

<sup>1</sup>Molecular pathology, immune-phenotype, cryopreservation, work sent out

TABLE-4 | Treatments performed in the last 2 weeks of life from 2002 -2013

Treatments	Number of patients	Number of events
<b>Radiotherapy</b>		
Palliative intent	1,996	6,898 (87%)
Radical intent	213	1,043 (13%)
<b>Any radiotherapy</b>	2,198	7,939 (100%)
<b>Surgery</b>		
Elective	234	250 (84%)
Emergency	25	28 (9%)
Unknown	17	21 (7%)
<b>Any surgery</b>	267	299 (100%)
<b>Chemotherapy</b>		
Chemotherapy with overnight ward	80	82 (24%)
Chemotherapy day unit	217	257 (76%)
<b>Any chemotherapy</b>	287	339 (100%)

**FIGURE-1 | Proportion of 'active' cancer patients reporting health services utilization and potentially futile intervention in the last 2 weeks of life from 2002 to 2013**

