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# Palliative chemotherapy among people living in poverty with metastasised colon cancer: facilitation by primary care and health insurance

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## ABSTRACT

**Background** Many Americans with metastasised colon cancer do not receive indicated palliative chemotherapy. We examined the effects of health insurance and physician supplies on such chemotherapy in California.

**Methods** We analysed registry data for 1199 people with metastasised colon cancer diagnosed between 1996 and 2000 and followed for 1 year. We obtained data on health insurance, census tract-based socioeconomic status and county-level physician supplies. Poor neighbourhoods were oversampled and the criterion was receipt of chemotherapy. Effects were described with rate ratios (RR) and tested with logistic regression models.

**Results** Palliative chemotherapy was received by less than half of the participants (45%). Facilitating effects of primary care (RR=1.23) and health insurance (RR=1.14) as well as an impeding effect of specialised care (RR=0.86) were observed. Primary care physician (PCP) supply took precedence. Adjusting for poverty, PCP supply was the only significant and strong predictor of chemotherapy (OR=1.62, 95% CI 1.02 to 2.56). The threshold for this primary care advantage was realised in communities with 8.5 or more PCPs per 10 000 inhabitants. Only 10% of participants lived in such well-supplied communities.

**Conclusions** This study's observations of facilitating effects of primary care and health insurance on palliative chemotherapy for metastasised colon cancer clearly suggested a way to maximise Affordable Care Act (ACA) protections. Strengthening America's system of primary care will probably be the best way to

ensure that the ACA's full benefits are realised. Such would go a long way towards facilitating access to palliative care.

## BACKGROUND

Colon cancer is the second leading cause of cancer death in the USA, but its prognosis can be excellent with early diagnosis and expeditious access to evidence-based treatments.<sup>1 2</sup> Regrettably, though colon cancer screening and investigative technologies have begun to proliferate, one out of every five Americans with colon cancer has stage IV disease at the time of their diagnosis.<sup>3–5</sup> Many people with such late stage disease that has typically metastasised to the liver or lungs could benefit greatly from palliative chemotherapy. Synthetic randomised trial-based evidence has demonstrated its comforting as well as modest survival-enhancing effects, but it seems that only about half of those people with distally metastasised colon cancer in the USA ever receive such palliative care.<sup>5–7</sup>

Our research group has studied colon cancer care among those who live in America's highest poverty neighbourhoods where 30–40% or more of the people have incomes below the poverty line.<sup>8 9</sup> Similar to curative treatment barriers observed among those with non-metastasised colon cancer and consistent with this field's synthetic evidence,<sup>4 10–13</sup> we and others have observed significant barriers to palliative chemotherapy among people living in poverty with

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## Research

metastasised colon cancer.<sup>5 14 15</sup> Furthermore, our analyses found that prevalent health insurance inadequacies in America accounted for most, but not all of the poverty-based chemotherapy inadequacies, whether the intention was to cure or comfort. Our premise has been that focusing on the experiences of the most vulnerable people in the most vulnerable places magnifies clinical, policy and human significance.

Barbara Starfield, the late preeminent primary care researcher and advocate, argued that adequate insurance is necessary, but not sufficient to facilitate access to high-quality healthcare. She theorised that adequate primary care also plays a significant facilitating role.<sup>16</sup> Studies in the USA have consistently observed protective associations of primary care physician (PCP) supplies with colon cancer diagnosis, treatment and survival.<sup>10 17 18</sup> Starfield also contended that increased specialist physician (SP) supplies diminish public health by increasing the chances that patients will receive inappropriate or unnecessary specialised care.<sup>19</sup> She centrally theorised that the more specialists, the lower the volume of procedures for each one, unless the rate of performance of procedures also increases. So risks of overusing non-indicated therapeutic interventions and not performing indicated palliative interventions probably increase with an increased supply of specialists. This notion of hers was critiqued on methodological grounds for not controlling for socioeconomic status in cross-sectional analyses.<sup>20 21</sup> In fact, in the field of colon cancer care, SP effects have been less consistent and have tended not to fit Starfield's theory. For example, a Florida study observed a greater risk of late stage diagnosis in places that were relatively well supplied overall with SPs.<sup>18</sup> In contrast, our studies in California observed null to modestly protective association of gastroenterologist supplies with disease stage at diagnosis and survival.<sup>10 17</sup> However, none of these studies focused specifically on metastasised disease or palliative care, per se. We are not aware of any longitudinal study that has examined the independent, income-adjusted effects of health insurance and physician supplies, PCPs and specialists, on palliative colon cancer care. This historical observational study does so.

Recent research found that more than half of all PCPs provide ongoing care to their patients with cancer.<sup>22</sup> Also, our own clinical experience suggests that cancer care specialists probably tend to err on the side of intending to treat for cures. For these reasons, we think that the palliative care of metastasised colon cancer probably fits Starfield's theory well: increased PCP supplies enhancing access, increased SP supplies diminishing access. Therefore, our research and practice experience combined with Starfield's theory produced the following hypotheses about the palliative care of those with metastasised colon cancer. First, people with adequate health insurance will have better

access to palliative chemotherapy. Second, people living in places with adequate PCP supplies will also have better access to such care. And third, people living in places with ample SP supplies will have worse access to such care.

Of course, palliative care encompasses a wide range of interventions and care approaches. We had access to secondary data that would allow us to explore surgical and chemotherapeutic palliation. This field's, above referenced, historical and theoretic contexts, however, found few socioeconomic gradients and little managerial or clinical discretion in surgical care. Thus, we focused on palliative chemotherapy in this study, where we suspect larger socioeconomic gradients and much more managerial and clinical discretion.

## METHODS

### Study sample

Originally, we randomly sampled 5776 people who were diagnosed with colon cancer in California between 1996 and 2000 and followed them to the present. Moreover, we oversampled those who lived in poverty. This secondary analysis focused on the 1199 people with stage IV colon cancer that had distally metastasised at the time of their diagnosis<sup>23</sup> and were followed up for 1 year. The Cancer Registry of Greater California, anonymised for our analyses, was the sampling frame. 'Gold standard' is one of the most comprehensive and valid colon cancer registries in the world.<sup>24</sup>

The California registry does not collect income data, so we used patient residential census tracts at the time of their diagnosis to join it to neighbourhood-level census data in 2000.<sup>25 26</sup> One-third of the original study participants were randomly selected from high poverty neighbourhoods where 30% or more of the people were poor, that is, they had household incomes below the federally established poverty criterion.<sup>8 9</sup> Four of every 100 Californians live in such high poverty neighbourhoods.<sup>25</sup> The remaining participants were randomly selected from lower poverty neighbourhoods (<30% poor).

### Health insurance and physician supply measures

Health insurance data were collected from hospital records by cancer registrars. Primary health insurers were defined as private (these included Medicare-insured with private supplemental coverage), public (Medicare alone or Medicaid) or none. Our previously referenced research has consistently found public health insurance, Medicaid or Medicare, and of course having no such insurance, to be relatively inadequate when compared with more adequate private health insurance. We then identified communities with relatively low to high healthcare

endowments, characterised by physician supplies. To do this, we joined participants to county-level active, full-time equivalent, physician data via the American Medical Association's database in 2000.<sup>27</sup> PCPs were those who reported their speciality area as general or family practice. Physicians reporting the majority of their time spent in specialised practice or were board certified in that speciality were so defined.<sup>28</sup> Threshold effects, below which the study sample was less likely to receive palliative chemotherapy, were identified by exploring 0.5 physician increments: PCPs and aggregate SPs per 10 000, and gastroenterologists, general surgeons and oncologists, medical or surgical, per 100 000 community inhabitants.

### Analysis

Tumours were prevalently high grade. Only 6% were well differentiated. Most people with such late stage-high grade tumours could probably benefit from chemotherapeutic palliation. This characteristic did not confound any analysis, so it was not entered into any standardisation or regression. We directly and internally adjusted chemotherapy rates using a standard population with the age characteristics of this study's sample. Such adjustments were made across these age categories: 25–59, 60–69, 70–79 and 80 or older. The standard was used to calculate comparable age-standardised rates for respective adequately and inadequately insured and supplied subsamples. All rates were calculated per 100 participants and reported as percentages. We used standardised rate ratios (RR) for between-group comparisons with 95% CIs derived from the  $\chi^2$  test. The original analysis was specifically powered to detect small therapeutic rate differences. The available sample of 1199 for this secondary analysis of palliative chemotherapy allowed for confident detection of rate differences as small as 5% (two-tailed  $\alpha=0.05$ ; power<sub>1- $\beta$</sub> =0.80).<sup>29</sup>

We then used logistic regression models to test hypotheses.<sup>30</sup> We estimated the strength of each predictor-palliative chemotherapy relationship adjusting for the effects of other predictors as well as for the potentially confounding influences of age and poverty. ORs and 95% CIs were estimated from regression statistics. The criterion variable of palliative chemotherapy receipt seemed to have additional clinical validity as those who received it were also twice as likely to survive for 1 year.

### RESULTS

The effects of health insurance and physician supplies, primary care and specialists, are described in [table 1](#). First, being adequately insured by a commercial or private insurance company was associated with a 14% increase in the receipt of palliative chemotherapy (RR=1.14, 95% CI 1.00 to 1.30). Chemotherapy rates among the uninsured or Medicaid or Medicare-insured did not differ significantly from

**Table 1** Effects of health insurance and physician supplies on palliative chemotherapy for 1199 people with metastasised colon cancer

Baseline	Chemotherapy	Rate	95% CI
Observed group	Sample rate (%)	ratio	
Uninsured or publicly insured	662	40.3	
Privately insured	537	45.9	1.14* 1.00 to 1.30
<8.5 primary care physicians†	1083	42.8	
≥8.5 primary care physicians†	116	52.6	1.23* 1.00 to 1.51
<16 specialist physicians‡	512	47.4	
≥16 specialist physicians‡	687	41.0	0.86* 0.75 to 0.98
<2 gastroenterologists‡	174	50.7	
≥2 gastroenterologists‡	1025	43.5	0.86 0.73 to 1.02§
<7 general surgeons‡	117	48.7	
≥7 general surgeons‡	1082	44.0	0.90 0.73 to 1.11
<3 oncologists‡	550	48.6	
≥3 oncologists‡	649	41.1	0.85* 0.75 to 0.96

\*p<0.05.

†Physician densities per 10 000 community inhabitants.

‡Physician densities per 100 000 community inhabitants.

§90% CI 0.75 to 0.99, p<0.10.

each other. Second, living in a community that was adequately supplied with 8.5 or more PCPs per 10 000 inhabitants substantially increased one's chances of receiving chemotherapy by 23% (RR=1.23, 95% CI 1.00 to 1.51). Such adequately PCP-supplied communities were also associated with substantially decreased chances of waiting longer than 2 months to receive chemotherapy (19% vs 31%, RR=0.61, 95% CI 0.47 to 0.80, data not shown). And third, living in a community that was very well supplied with 16 or more SPs per 10 000 inhabitants decreased one's chances of receiving chemotherapy by 14% (RR=0.86, 95% CI 0.75 to 0.98). Furthermore, the effects of specific specialists all followed this pattern, though they ranged from significant (oncologists) to non-significant trends (general surgeons). The effect of gastroenterologists approached statistical significance (RR=0.86, 90% CI 0.75 to 0.99). All effects were hypothetically consistent. Despite such facilitation by primary care and health insurance, it should be noted that the chemotherapy rate for the sample as a whole was only 45%.

As an aside, we also explored these effects on the receipt of palliative surgery, and found that only those with any health insurance (73%) were much more likely than the uninsured (45%) to receive such surgery (RR=1.62, 95% CI 1.37 to 1.92). Surgery rates among the privately or Medicare or Medicaid-insured did not differ significantly from each other. Neither PCP nor SP supplies affected surgery rates.

## Research

Two logistic regression models that tested predictors of palliative chemotherapy are displayed in table 2. Model 1 that was not adjusted for poverty essentially replicated the previously described protective effects of primary care and health insurance as well as the seemingly harmful effect of specialised care. Model 2 that was poverty-adjusted suggested the precedence of primary care in predicting access to palliative chemotherapy for those with metastasised colon cancer. The still statistically significant effect of PCP supply was quite large (OR=1.60, 95% CI 1.02 to 2.56), but the size of the health insurance and SP effects were attenuated and/or no longer statistically significant.

## DISCUSSION

Palliative chemotherapy was received by less than half of this historical California cohort's participants with metastasised colon cancer. As hypothesised, significant facilitating effects of primary care and health insurance as well as an impeding effect of specialised care were observed. Primary care seemed to take precedence. Controlling for poverty, PCP supply was the only predictor of chemotherapy receipt that remained statistically significant and practically strong. Adequate primary care was also protectively associated with much shorter waits for palliative chemotherapy. The threshold for these primary care effects was quite high though, only being realised in quite amply supplied communities with 8.5 or more PCPs per 10 000 inhabitants. Only 10% of this study's participants lived in such very well-supplied communities.

This study's central findings on palliative chemotherapy were consistent with those of another recent

study of people with non-metastasised colon cancer treated with the intent to cure.<sup>10</sup> Among California and Ontario samples, a less stringent PCP supply threshold of 7.5 or more PCPs for every 10 000 community inhabitants was protectively associated with 10-year survival. Consistent with Starfield's further theorising about the benefits of Canada's stronger primary care orientation,<sup>31</sup> the protective PCP-survival association was stronger in Ontario than California. Moreover, among that study's sample of people with non-metastasised colon cancer, 4 of every 10 in Ontario, but only 1 of every 10 in California lived in such adequately supplied communities.<sup>10</sup> We had access to a contemporaneous sample of people with metastasised colon cancer in Ontario, but unfortunately, it was too small to provide statistically powerful and so confident comparisons. It does, however, suggest again that Canadians are much more likely to live in communities that are very well supplied with PCPs. For example, 3 of every 10 such Ontarians (unpublished data) compared with this study's estimate of only 1 of every 10 Californians lived in communities that were very well supplied with 8.5 or more PCPs for every 10 000 inhabitants. Therefore, one would expect much better access to palliative chemotherapy for metastasised colon cancer in Ontario. These Ontario data also suggest that oncologist supplies (3 or more per 100 000 community inhabitants) may facilitate, rather than impede, access to palliative chemotherapy in Ontario (RR=1.33, 90% CI 1.02 to 1.73, unpublished data). Provocative international comparisons remain for future research testing with ample, prospective cohorts. Clinical and policy decision makers in the USA may have much to learn about primary care as well as primary-specialist care collaborations in palliative care from their Canadian neighbours.

**Table 2** Logistic regression of health insurance and physician density on the receipt of palliative chemotherapy for 1199 people metastasised colon cancer

Predictor variables	OR	95% CI
<i>Model 1: age-adjusted</i>		
Privately insured	1.34*	1.03 to 1.74
≥8.5 primary care physicians/10 000 community inhabitants	1.61*	1.05 to 2.47
≥16 specialist physicians/10 000 community inhabitants	0.63*	0.49 to 0.81
<i>Model 2: Age and poverty-adjusted</i>		
Privately insured	1.21	0.97 to 1.52
≥8.5 general practitioners/10 000 community inhabitants	1.62*	1.02 to 2.56
≥16 specialist physicians/10 000 community inhabitants	0.74	0.50 to 1.02

All effects were adjusted for age (25–59 (25%), 60–60 (24%), 70–79 (28%) and 80 years or older (23%)) and all other effects in each model. Model 2 was further adjusted for living in a high poverty neighbourhood (33%). Total physician supply did not enter either model after primary care and specialist physician supplies entered. Gender (50% each women and men) did not enter either model nor did it interact with any other effect, so this pattern is likely the same for women and men.

\*p<0.05.

## Potential limitations

Our findings may not be generalisable to all Americans. However, because 1 in 10 Americans lives in California, we think they have ample external validity.<sup>32</sup> Admittedly, in that we purposefully over-sampled those who lived in poverty, this study's findings are most representative of their experiences. Furthermore, California's expanded Medicaid programme is more liberal than most states', so estimates of healthcare inequities among the poor or near poor there are probably underestimates of the nation's.<sup>33–35</sup> Next, because chemotherapy is most often received as an outpatient, it can be challenging for cancer registries to survey. However, the Cancer Registry of Greater California was nearly complete on chemotherapy at the time of this analysis.<sup>36</sup> And any modest errors probably did not differ by socioeconomic factors such as income or health insurance<sup>37</sup> so were very unlikely to have confounded this study's analyses. This study was also limited by the fact that its



physician supply measures were county-level aggregates and so did not directly examine individual physician behaviours and physician–patient relationships. Instead, they were conceived as proxies of community-level phenomena, that is, of healthcare service endowments. Therefore, we think that population-level policy-relevant inferences can be most appropriately drawn from this study. Future research, observational and qualitative, will be needed to sort out the relative clinical importance of various PCP behaviours, for example: provision of initial information, active referral, liaison with oncologists and other specialists, advocacy for palliative care, prevention or management of adverse palliation effects, care coordination and ongoing surveillance. Relatedly, we were not able to measure patient behaviours. Those of most interest, of course, would be those related to their quality of life, social supports and preferences.<sup>38–40</sup> Future studies ought to include such individual-level patient measures as well.

It could also be argued that referral to palliative chemotherapy may not have been appropriate for all such patients. But our practice experience suggests that most people, like this study's participants with late stage-high grade tumours, could probably benefit from chemotherapeutic palliation. In fact, there seemed to have been few cases where referral to palliative chemotherapy was not appropriate. Medical records indicated that such care was contraindicated in <1% and refused in <5% of the cases. These few cases were unlikely to have confounded our analysis as we controlled for their probable key predictors: age, stage and grade through mathematical modelling (logistic regression) and sample restriction. Finally, we studied metastasised colon cancer because we suspected it was a sentinel palliative care indicator, but there probably are many others. Presently, we are designing a systematic replication among women with certain forms of breast cancer that are generally not amenable to treatment for cures. We invite other teams of clinicians and researchers to replicate and extend these findings across other diagnostic, including non-cancer, groups in need of high-quality palliative care.

## CONCLUSIONS

This historical study's observations of the facilitating effects of primary care and health insurance on palliative chemotherapy for metastasised colon cancer prior to enactment of the Affordable Care Act (ACA) clearly suggested a way to maximise ACA protections. Notwithstanding the importance of adequately insuring all, strengthening America's system of primary care will probably be the best way to ensure that the ACA's full benefits are realised. Such would go a long way towards facilitating access to palliative care.

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## Research

**Competing interests** None declared.

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# Palliative chemotherapy among people living in poverty with metastasised colon cancer: facilitation by primary care and health insurance

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