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Research paper

An investigation into the usability of a drug-complementary medicines interactions database in a consumer group of women with breast cancer

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ABSTRACT

Introduction: It is known that complementary and alternative medicine (CAM) use can be high in people with cancer. Despite a plethora of information about CAMs on the internet, reliable, evidence-based information about potential interactions between CAMs and pharmaceuticals is not readily accessible to consumers. An online pharmaceutical-CAM interactions database, IMgateway, designed for healthcare practitioners, has begun to be adapted for consumer use. We sought to assess the usability of the IMgateway and investigate perceptions and behaviour of breast cancer patients in relation to CAMs.

Methods: An online survey was conducted in members of the Review and Survey Group of the Breast Cancer Network of Australia. Part 1 included questions about CAM use/perceptions. Part 2 required participants to work through a concurrent drug-CAM scenario using IMgateway then answer questions on usability. Quantitative analysis (closed questions) and qualitative analysis (open-ended questions) was conducted (qualitative using thematic analysis with NVivo v11).

Results: 202 females completed the survey. After diagnosis, 57% respondents changed their CAM use; most common reasons were advice from their doctor/oncologist, to assist with side effects and as prevention/well-being enhancement. 45% believed concurrent pharmaceutical and CAM use was safe; an equal percentage were unsure. 73% indicated concern about potential interactions when specifically asked. In the scenario task, a correct response rate was almost 80% for two scenarios but only around 50% for the other two. 71% found IMgateway either useful/very useful to ascertain safety of a particular CAM/pharmaceutical combination and more than 50% indicated they were confident making an informed choice.

Conclusion: With refinement the database has potential to empower consumers to be proactive in management of their health conditions, including mitigating risks associated with potential pharmaceutical-CAM interactions.

1. Introduction

Between 69% and 80% of Australians use some form of complementary and alternative medicine (CAM) [1,2]. The term CAM is broad and can encompass complete systems of medicine (eg. Chinese medicine and Ayurveda), ingestible forms including herbal medicines and nutritional supplements (eg. vitamin and mineral supplements), physical therapies (including massage, acupuncture), movement therapies (eg, Alexander technique), energy-based therapies (eg. Reiki), and others, all with varying levels of scientific evidence. Around 8 million Australians usually take more than two forms of CAM each week [2]. People living with cancer and cancer survivors are high CAM users [3,4]. In a US survey, 65% of those ever diagnosed with cancer had used CAM approaches [4], whilst other studies indicate approximately 40% of cancer patients use CAM therapies [5,6] with higher rates in specific subpopulations such as breast cancer patients [7]. A study found that breast cancer patients use CAM more than patients with other types of tumours (84% vs 66%) [8]. Also, at the early stage of breast cancer treatment, about 57% of patients reported using CAM (most commonly vitamins) [9]. Another study of 77 women with breast

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cancer found that 97% were already using CAMs at the time of diagnosis (most frequently used CAMs being prayer, multivitamin use, massage, vitamin E and C use, music therapy, meditation, green tea, chiropractic treatment, and vitamin A use at baseline). After 6 months (n = 65 respondents), 33 (50.8%) indicated no change, and 32 either discontinued or added some specific types of CAM [10]. Overall reasons for taking CAMs gleaned from various studies include: strengthening the immune system, improving emotional/physical well-being, reducing stress and physical symptoms, and gaining a feeling of control over treatment [10].

Self-medication with CAMs to improve health and wellbeing is consistent with the tenents of 'self-care', defined by the World Health Organization (WHO) as *'the ability of individuals, families and communities to promote health, prevent disease, and maintain health and to cope with illness and disability with or without the support of a health-care provider'* [11]. This definition recognises the active role of the patient in their own healthcare, as opposed to a passive recipient of treatment. The report *The State of Self Care In Australia* states that: '*A healthy population is achieved through a functional relationship between active and informed individuals, health care services that empower and support people, and governments that invest in the capabilities of individuals and communities to look after their health*' [12].

Whilst self-care is very important, there can be dangers associated with polypharmacy [13], and for those concurrently taking ingestible forms of CAMs (i.e. herbal medicines, vitamins and mineral supplements) and pharmaceuticals the safety concerns relate to potential adverse interactions [14]. Extrapolating the findings of a 2018 survey of 1015 Australians to the general population indicates that more than 7 million Australians are taking some form of CAM each day and that 59% of these were also taking prescription medicine [15]. US research indicates a high concurrent use of prescription medicine and CAM: 43% in a study of war veterans [16] and 74% in a study of elderly people [17]. Warfarin is known to interact with several commonly used ingestible CAMs including glucosamine and the Chinese herb Radix Salviae Miltiorrhizae (pinyin Dan Shen) [18–20].

Australian consumers seek information about CAMs from a variety of sources. An Australian survey of 947 people found consumers sought information about CAMs from family and friends (55%), the Internet (51%), health food shop workers (38%), pharmacists (37%), magazines (37%), doctors/general practitioners (34%), and package inserts/labels/pamphlets (30%) [21]. However, many Australians have suboptimal health literacy, which is associated with poorer health outcomes, independent of socioeconomic factors [22]. Health literacy as it relates to individuals is a 'measure of an individual's capacity to seek, understand and use healthcare information within the healthcare setting', with low levels of health literature associated with poorer outcomes [22]. Health literacy is a crucial determinant of public and individual health, and also of self-care [23–25]. Lower health literacy has been found to be associated with greater knowledge deficits and less adherence in patients taking oral anti-coagulants [25]. Another study in the cardiovascular medicine field indicates that poorer adherence to self-care behaviour correlated with patients with lower health literacy and that critical health literacy (the ability to critically evaluate information) was an independent predictor of self-care behaviour. The study authors concluded that effective interventions were needed to be developed to improve patient skills for critically analysing information and making decisions [23]. Australian research indicates those with the highest CAM supplement or remedy use had significantly lower health literacy scores than the reference group (68% CAM use), as did those with the lowest CAM supplement or remedy use [22].

Despite the inclusion of doctors in the information source list above, Australian research has found that almost 52% do not discuss their CAM use with their doctor [1], and other studies indicate that cancer patients do not discuss their CAM use with their oncologist either [26]. A compounding issue is that general practitioners often do not feel prepared or able to contend with patient questions about CAM use and effectiveness [27], and are cautious about recommending or discussing CAM due to concerns about efficacy, safety and regulation [28,29]. There is very little training about CAM in most undergraduate medical curricula in Australia.

The Australian Medical Association's *Position Paper on Complementary Medicines 2018* states that: '*Consumers should have access to accurate information and education about the level of evidence for complementary medicines and therapies in order to make well-informed choices. This should include the risks and opportunity costs of delaying conventional treatment*' [30]. The Clinical Oncology Society of Australia (COSA)'s 2014 position paper on CAM encourages health professionals to engage in open discussion with patients about CAM and evidence-based medicine, become familiar with reputable sources of CAM information, and recognise limitations in their own knowledge and seek further advice when necessary [31]. The National Prescribing Service MedicineWise has called for increased consumer education about potential interactions between CAM and prescription medicines [15]. The Pharmaceutical Society of Australia (PSA) identifies the need for medicine safety to be a National Health Priority Area. Dr Freeman, PSA President stated: *'I always say that medicine safety is everyone's responsibility. That includes consumers themselves and we need to empower consumers to be able to connect with pharmacists who are experts in medicine safety……'* [32].

There is a clear need for trustworthy, evidence-based information about potential interactions between pharmaceuticals and ingestible forms of CAM such as nutritional supplements and herbs for both healthcare professionals and for consumers. As discussed earlier, the potential for adverse interactions is well documented in the literature [14,15,18–20,33].

The IMgateway (Integrated Medicine) interactions database is an online database that sets out potential interactions between various CAMs (western herbs, foods and nutritional supplements) and pharmaceutical drugs. It was developed by UnityHealth Pty Ltd in collaboration with the University of Sydney's Department of Pharmacy and has been available for over ten years to healthcare practitioners. The IMgateway interactions database provides a 'traffic light' recommendation of the likelihood of an interaction (red- Avoid combination; yellow-Caution; green-Interaction Unlikely, with blue-Inconclusive) then allows the user to click on the summary of the particular pharmaceutical-CAM combination which then gives relevant patient advice, rates the level of evidence upon which the recommendation is made, and provides a summary of the research evidence with links to the actual scientific papers.

Responding to the need for consumers to have up-to-date, reliable, evidence-based information about complementary medicines, UnityHealth has begun to adapt the IMgateway interactions data for use by consumers. As part of this process, we tested out its useability and usefulness within a subpopulation known to be high users of CAM, with the view to refining the tool further.

2. Study Design

2.1. Overview

A survey was conducted to assess the useability of the IMgateway interactions database, to seek feedback on how its design could be modified for consumers and to assess the potential usefulness of the database as a consumer resource. A secondary aim was to understand the perceptions and behaviours around common forms of ingestible forms of CAMs (as distinct from forms of CAM which are mind-body interventions). In alignment with the National Commission on Safety and Quality in Health Care, which advocates the embedding of partnerships in healthcare [34], a research team was formed which included a consumer representative, two consumer representatives from the Breast Cancer Network Australia (BCNA) and academics from various discipline fields (Chinese medicine, integrative medicine,

information technology, pharmacy).

2.2. Objectives

The objectives of the research project were to investigate the:

- usability of the IMgateway database, including ease of use and the nature of its features or improvements to features that would make it easier to use and/or more valuable to a consumer
- potential value of the IMgateway database to consumer decision-making behaviour
- the perceptions and behaviours of breast cancer patients in relation to CAM use

2.3. Survey design

The survey was created using the online survey tool Survey Monkey and refined through discussion between members of the research team. In part 1, participants were asked questions about their (ingestible) CAM use. These included closed questions as well as open-ended questions.

In part 2, participants were given access to the IMgateway interactions database and asked to work through four scenarios which were combinations of particular pharmaceutical drugs and ingestible forms of CAMs, to ascertain if the combination was safe or not. The specific combinations were: Taxol (Paclitaxel) and St John's Wort (also known as Hypericum perforatum); Taxol (Paclitaxel) and a branded product Cenovis 'Echinacea, Zinc, Garlic and (Vit) C'; Nexium (esomeprazole) and St John's Wort; and Nexium and Cenovis 'Echinacea, Zinc, Garlic and (Vit) C'. Note that the brand name Nexium was used (not the generic) in the actual survey. Respondents were asked to choose one of three possible responses in relation to each drug-complementary medicine pair: Go (safe to use), Caution, or Stop (not safe). Participants were then asked a series of eight questions about the database focused on usability and value to them. These included closed questions, including questions with a 4- or 5- point Likhert scale, and open-ended questions.

2.4. HREC approval

Approval for the research project was granted by the National Institute of Integrative Medicine (NIIM) Human Research Ethics Committee on 7 December 2017.

2.5. Survey implementation

The research team was comprised of two members of the Breast Cancer Network of Australia (BCNA), a consumer representative, as well as academics across several disciplines (including pharmacy, Chinese medicine, and information technology). The BCNA is the peak national association representing breast cancer in Australia. It is a network of more than 120,000 members, more than 90% of whom have had a diagnosis of breast cancer (remaining members have had personal experience through a family member or friend) (see https://www.bcna.org.au/).

Meetings were held on a regular basis, from conception of the project through to survey design and final report, putting the theory of co-design into action.

The survey was distributed to the 1687 members of the Review and Survey Group of the BCNA via an email sent by the BCNA on 13 February 2019. The BCNA Review and Survey Group is a group who have indicated willingness to be involved in research projects (see https://www.bcna.org.au/get-involved/participate-in-research/review-survey-group/join-the-review-survey-group/). A Facebook post about the research project was sent in the second week that the survey was 'live'. The survey was then closed on 1 March 2019. The survey had to be accessed via a computer, not a tablet or mobile device for this research project.

2.6. Data analysis

Quantitative analysis was conducted, with data presented as percentages and frequencies. Note that not all participants responded to all questions. Thus, results are presented inclusive of the number of respondents to each question.

Open-ended questions were analysed using thematic analysis, a common technique used in qualitative research, using the qualitative research software NVivo (version 11). Grounded theory method, which is based on phenomenological thinking and emphasises the identification of categories and concepts within data in order to support the construction of claims, underlies the thematic analysis methodology that will be employed. Thematic analysis was conducted using the method suited to 'concurrent design' whereby themes arising from the data are systematically coded and categorised. To assure the trustworthiness of the data, triangulation was conducted between two researchers. Each researcher independently coded the responses for six (open-ended) questions with 80% agreement. The remaining codes and themes were discussed by the two researchers until complete agreement on these was reached.

3. Part 1 Results

3.1. Survey respondents

A total of 202 of the 1687 members of the Review and Survey Group of the BCNA responded to the survey, all females (response rate 12%). The majority (88%) of respondents have been diagnosed with early stage breast cancer where the cancer is confined to the breast and/or lymph node(s). Another 7.5% of respondents have metastatic breast cancer and 4.5% responded as 'other'. A small number of respondents (n = 13) completed the survey on behalf of someone with breast cancer. The age distribution of respondents is set out in Fig. 1. All states and territories were represented by respondents.

3.2. CAM use before diagnosis

- *Q. Prior to your diagnosis, did you use complementary and/or alternative medicines (CAMs)?*
- *Q. If Yes, what forms of complementary and/or alternative medicines (CAMs) did you use? [Tick one or more boxes]: 'herbal medicine', 'Chinese herbal medicine', 'vitamins and/or mineral supplements', 'homoeopathic', 'other nutritional supplements'*

The majority of respondents used CAMs prior to their breast cancer diagnosis (72%, n = 185 respondents). The most common ingestible forms of CAMs were vitamin and mineral supplements which were used by 91% of respondents (n = 171) (see Fig. 2).

3.2.1. Qualitative responses

Respondents were asked to describe what forms of CAM they used prior to diagnosis. Analysis of the qualitative data answers from 112

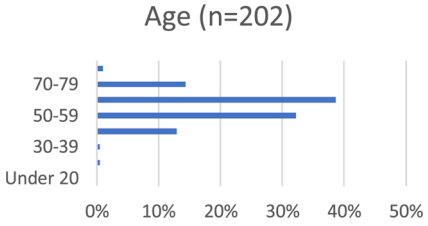

Fig. 1. Age group distribution of respondents.

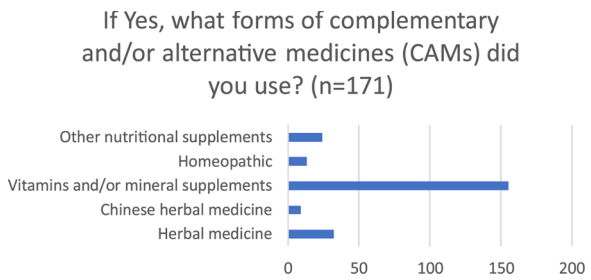

Fig. 2. Forms of CAMs used prior to diagnosis.

respondents indicated that the main CAMs consumed were (in descending order): Vitamin D (n = 33 respondents), fish oil/omega 3 oils (n = 24 respondents), multivitamins (n = 21 respondents), Vitamin B (n = 20), Vitamin C (n = 19), magnesium (n = 18), calcium (n = 15), glucosamine (n = 12), evening primrose (n = 6), turmeric/curcumin (n = 4), probiotics (n = 4), iron (n = 4) plus other miscellaneous CAMs (n = 26). Note that respondents could choose more than one response for this question.

3.3. CAM use after diagnosis

- *Q. Did your breast cancer diagnosis change your use of complementary and/or alternative medicines (CAMs)?* (Yes/No response option)
- *Q. How has your use of complementary and alternative medicines (CAMs) changed?* (Six response options: I have stopped/reduced/maintained/increased my use of CAMs or subsequently started using CAMs or I do not use complementary and/or alternative medicines)

Following breast cancer diagnosis, 57% of respondents indicated that their use of CAM changed, whilst 43% indicated that it didn't (n = 185 respondents). Responses indicate that subsequent to breast cancer diagnosis, 9% stopped their use of CAMS, 14% reduced their use of CAMs, 13% subsequently started using CAMs, 23% maintained their CAM use, and 29% increased their CAM use (12% responded that they do not use CAMs)(n = 180). See Fig. 3.

3.3.1. Qualitative responses

Respondents were asked to explain why their use of CAMs had changed. Answers were provided by 136 participants. Analysis of the qualitative data indicated that most commonly it was advice from a healthcare professional influenced the decision to maintain use, begin to use or cease use of CAM (n = 31 responses: doctor/oncologist in 26 cases, pharmacist in 2 cases, naturopath in 2 cases, acupuncturist in 1 case). Of the 26 respondents who had changed their CAM use on advice of the doctor/oncologist, the majority indicated they had started or continued to use CAM (n = 20) with a small number (n = 6) indicating they ceased taking CAMs on advice of doctor/oncologist.

The following quote exemplifies the dilemma and tension that some people find themselves in, when the patient wants to take CAMs and the doctor is against it:

- *"I have finished my cancer treatment and am slowly returning to using some CAMS. During active treatment - chemotherapy and Herceptin my Oncologist and I argued all the time about the added dangers of CAMS. Every time a blood test wasn't as good as he thought it should be "I must be taking an alternative medicine".*

The next most common reasons given for why CAM use changed were to assist with the side effects of treatments (n = 18), or for prevention and to enhance wellbeing and immunity (n = 12). Some of the side effects of treatment mentioned included: pain, joint pain, side-effects of cancer medication, and side effects of hormone therapy (bone aches, insomnia, cognitive decline and menopausal symptoms).

The following quotes exemplify the notion that for some women, commencement of the use of CAMs is a demonstration of proactivity and taking responsibility for their own health, an adoption of the principles of 'self-care'.

- *"At the time of being diagnosed with cancer, I decided that I needed to amend my lifestyle and this included alternative medicines".*
- *".....Since having had cancer I am far more interested in relieving my body of chemicals and look more to food as an ongoing maintenance of good health. Further to that, at the time it allowed me to feel proactive in my decisions and in helping myself heal".*

3.4. Perceptions of safety

- *Q. How safe do you believe it is to use CAMs at the same time as pharmaceutical drugs?* (Three response options: safe, unsure, unsafe).
- *Q. Are you concerned about potential interactions between pharmaceutical drugs and CAMs?* (Yes/No response option)

Of 168 respondents, 45.5% believed concurrent use of CAMs and pharmaceuticals to be safe, 45.5% were unsure and 9% believe them to be unsafe. However, when asked specifically if they were concerned about potential interactions between pharmaceutical drugs and CAMs, approximately 73% of respondents answered affirmatively, whilst 27% indicated they were not concerned (n = 185 respondents to this question).

3.4.1. Qualitative responses

When asked to explain (n = 155 responded) many respondents indicated that it was safe as they had checked the CAMs with their doctor/oncologist or pharmacist. This is exemplified in the following responses from two survey participants:

- *"As long as oncologist knows what you are taking".*
- *"As long as you follow medical direction that it is safe: trust the medical practitioner judgement: easy to research and ask second opinion"*

The main themes or concerns about safety in relation to using CAMs and pharmaceuticals concurrently were (in order of most prevalent responses from the qualitative analysis):

- Interactions between CAMs and pharmaceuticals may reduce effectiveness of drugs
- Safety depends on the CAMs and drugs involved
- Lack of clear information about safety and interactions
- Concern about potential side effects

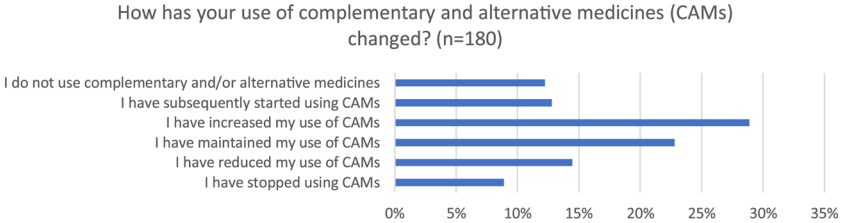

Fig. 3. Change in CAM Use following breast cancer diagnosis.

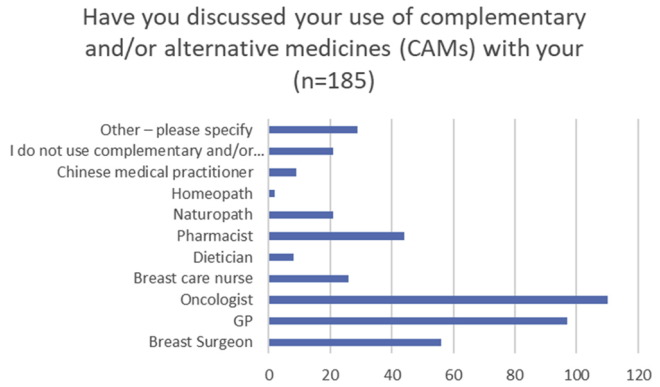

Fig. 4. Number of respondents who have discussed CAM use by practitioner type.

However, respondents also gave a variety of reasons why they felt CAMs were safe to use with pharmaceutical drugs.

3.5. Communication about CAMs with healthcare professionals

- *Q. Have you discussed your use of complementary and/or alternative medicines (CAMs) with your: [Tick one or more boxes]: GP, oncologist, breast care nurse, dietician, pharmacist, naturopath, homeopath, Chinese medical practitioner, nutritionist, other-please specify.*

When asked about whether they discussed CAM use with a range of healthcare practitioners, of the 185 respondents (more than one response allowed), the following frequencies were found: their oncologist (59% respondents), general practitioner (52%), breast surgeon (30%), pharmacist (24%), breast care nurse (14%), and naturopath (11%). See Fig. 4.

3.6. Sources of information about CAMs

- *Q. Where do you get your information about complementary and/or alternative medicines (CAMs)? [Tick one or more boxes]*

A variety of sources are used by respondents to access information about CAMs, set out in Fig. 5. Sources of information, from highest in descending order, are as follows: internet (46%), general practitioners (43% of respondents), oncologists (36%), breast cancer organisation (30%), friends or word of mouth (25%), pharmacist (19%), naturopath (19%), scientific journals (15%), with the other options making up lesser percentages (n = 185 respondents in total).

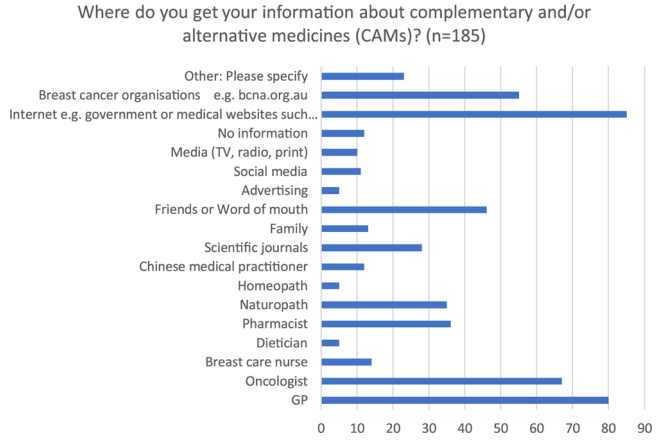

Fig. 5. Sources of information about CAMs.

Table 1
Responses to four potential interactions scenarios.

Scenario	Responses	Correct response
Docetaxel and St John's Wort combination (n = 99 respondents)	• 78% said STOP • 18% said GO • 4% said CAUTION	STOP
Docetaxel and Cenovis Enchinacea, Zinc, Garlic and Vit C combination (n = 97 respondents)	• 6% said STOP • 58% said GO • 36% said CAUTION	GO
Nexium and St John's Wort combination (n = 97 respondents)	• 15% said STOP • 6% said GO • 78% said CAUTION	CAUTION
Nexium and Cenovis Enchinacea, Zinc, Garlic and Vit C combination (n = 96 respondents)	• 9% said STOP • 49% said GO • 42% said CAUTION	GO

4. Part 2 Results: Usesability of the IMgateway Interactions Database

4.1. Scenario results

Less than half the respondents (n = 91) provided answers in the scenario section of the survey. The responses for each of the four scenarios is set out in Table 1 below.

4.2. Perceived usefulness and ease of use of interactions database

- *Q. Is the IMgateway useful in assisting you to find out whether it is safe to use the particular complementary medicines whilst taking particular pharmaceutical drugs?* (Possible responses: very useful, useful, neither useful nor useless, useless, very useless)

Of the 91 respondents to this question, 71% found that the interactions database was useful or very useful whilst 20% found it neither useful nor useless, and 9% useless or very useless.

- *Q. Was the IMgateway easy to use in the task of finding out whether it is safe to use the particular complementary medicines whilst taking particular pharmaceutical drugs?* (Possible responses: very easy, easy, neither easy nor difficult, difficult, very difficult).

Of the 91 respondents, 53% found the IMgateway very easy or easy to use, with a further 27% finding it neither easy nor difficult, and 19% finding it difficult or very difficult.

- *Q. Were problems encountered in finding out whether it was safe to use the complementary medicines in conjunction with the particular pharmaceutical drugs in the Scenario?* (Yes/No response).

A total of 52% indicated that they encountered problems in finding out whether it was safe or not to use a CAM/drug combination in the scenario, and 48% did not (n = 90 respondents to this question). When asked to explain, there were a range of responses. For example, some couldn't find the (Cenovis) product by brand, so had to search the constituents separately:

- *"Initially I couldn't find the Cenovis brand and then realised I could search on brand name under a different heading. Trial and error won in the end, but confusing to begin with".*

The comment below indicates that clearer instructions are needed when there is a branded CAM which is a composite of several

ingredients, as to what the person searching the database needs to do:

- *"I was not sure whether I could add several CAMS in the same scenario (example: Echinacea + Vit E + Zinc) and then match to one drug or if I should compare only 1 CAM and 1 drug at a time"*

4.3. Suggestions for improvement of interactions database

Key recommendations for improving the usability of IMgateway included creating instructions on how to use the database, including what to do for branded products and what to do if a particular branded product is not contained within the database; adding a reset or 'clear' button to allow to search again and provide a 'back' button to get back to the home screen; including an 'auto-complete' function in case the user didn't spell a herb/product name correctly (eg. Echinacea); making the website visually more appealing (eg. adding pictures) and adding a recommendation to 'Consult your healthcare practitioner about potential interactions between CAMs and pharmaceuticals'.

4.4. Confidence in making informed choices using the interactions database

- *Q. Using IMgateway, how confident are you about making informed choices about the safety of using a particular complementary medicine whilst taking pharmaceutical drugs?* (Three possible response options: confident, neither confident nor not confident, not confident).

A total of 57% (n = 89 respondents) felt confident, 33% were neither confident nor not confident, and 10% were not confident in making informed choices about the safety of using a particular CAM whilst taking pharmaceutical drugs, using the interactions database.

4.5. Consequences of study participation

- *Q. Has completing this questionnaire changed your perceptions about the use of CAMs with prescribed drugs?* (Yes/No response)

Of 91 respondents who replied to this question, 29% indicated yes and 71% indicated no. This issue was probed using an open-ended question format. Qualitative analysis (n = 86 respondents) indicated that the key themes were:

- No (n = 35)
- Yes (n = 24)
- Will still check with doctor or pharmacist (n = 20)
- Would like to use the IMgateway interactions database (n = 11)
- Will do more research (n = 8)

Of those who said no, the main reasons were that they were already careful or that they check or would check with their doctor/oncologist. For example:

- *'Not particularly, as I will always check with my oncologist/GP before continuing use'*
- *'No because I am confident my GP is up to date with drug interactions. However I would like to be able to check these myself, especially as my medications change'.*

Others indicated that completion of the survey did change their perceptions about concurrent use and that for some it would lead to a change of behaviour. For example:

- *'Yes, it has raised my awareness to be even more careful of mixing the two'*
- *'Yes I will check the CAMs with the medications I am taking. I presumed the GP did this automatically when they prescribed the meds for me'.*
- *'More likely to ask health professional before taking supplement when on a drug'*
- *'Yes, it has made me more aware of the importance to check. I hope that the database will certainly be available in the future. It seems to me an invaluable resource, particularly in a time when navigating your way through cancer when everything is overwhelming and you don't know what information to trust. It will be great to have a one-stop-shop of information'.*

4.6. Communication with healthcare professionals

- *Q. Has completing the questionnaire and using IMgateway made you more likely to discuss your CAM use with (you may choose more than one): medical practitioner, allied health care practitioner, pharmacist?*

The following responses were found:

- Medical practitioner: 63% yes, 37% no (n = 91 respondents)
- Allied healthcare practitioner: 47% yes, 53% no (n = 91 respondents)
- Pharmacist: 59% yes, 41% no (n = 90 respondents)

5. Discussion

This study was primarily focused on assessing the usability of the IMgateway, a drug-supplements interactions database, in a population of people known to high users of CAM, including ingestible forms of CAM. It is unknown why less than half of the survey respondents completed the scenario task. This might reflect a perception of complexity of the task, difficulties using the database, or could be indicative of level of IT literacy or health literacy. The IMgateway was designed as a healthcare practitioner tool, so it is possible that the level of information is simply too high for consumers and that language may need adaptation. In addition, almost 80% of those who did complete the scenario achieved the correct response for two of the combinations, however in the scenarios where they had to seek information on the branded product, the correct response rate was only around 50%. This suggests some difficulty in accessing information on a branded or named product in the interactions database; this might be improved through provision of instructions or other such refinements to the database.

Several useful ideas for improvement of the database should serve to help shape this into a very valuable consumer tool. Importantly, at the end of the survey and after completion of the Scenario, almost 60% of respondents indicated that they felt confident about making informed choices about the safety of use of CAMs whilst taking pharmaceuticals using the IMgateway. This indicates the potential usefulness of the IMgateway interactions database in providing consumers with a level of confidence as well as enabling pro-activity.

A secondary aim of this study was to understand perceptions and behaviours around ingestible CAMs in those with breast cancer. The percentage of CAMs use in survey participants was 72%, consistent with the literature that indicates CAM use in cancer patients is high [3–9]. An interesting finding in our study was in relation to change in CAMs use following breast cancer diagnosis: that subsequent to diagnosis, 13% began using CAMs, whilst 23% maintained use, 29% increased CAMs use, 14% reduced and 9% stopped use of CAMs. By way of comparison, in the study mentioned previously a higher percentage (97%) of women with breast cancer were using various forms of CAM at time of diagnosis though that study included ingestible and mind-body forms of CAM. In that study, after 6 months (n = 65 respondents), 33 indicated no change, and 32 either discontinued or added some specific types of CAM [10].

In our study, we found that advice from a doctor or oncologist was a popular reason for why their use of CAMs changed, and in the majority of cases, CAM use was started or continued on doctor advice with only a small number indicating they ceased CAM use on doctor advice. In

addition, analysis of some of the qualitative responses indicated a perception of safety for concurrent use of CAMs and pharmaceuticals if they had checked with their doctor/oncologist or pharmacist. This is interesting given that most doctors including oncologists receive little or no training in CAM and underscores the urgent need for inclusion in medical curricula, including in oncology training (for both doctors and nurses). Oncologists are in the ideal position to advise patients about the evidence base of CAMs if they are knowledgeable, in particular about whether concomitant use of chemotherapeutic and other pharmaceuticals and CAMs is detrimental or not. The need for CAM education to be integrated into medical curricula has been raised [35–37], in particular so that healthcare professionals can communicate with and give necessary guidance to patients [37], though tensions within the medical profession have been voiced [35]. Integrative care, where various healthcare practitioners work collaboratively to provide patient-centred care that respects the rights and wishes of the patient, is likely to be the best model. The public are already practising their own form of integrative medicine, evidenced by concurrent use of western pharmaceuticals and various forms of CAM.

The issue of lack of communication about CAM use with healthcare practitioners is again highlighted by our survey. Whilst it is encouraging that almost 60% discussed their CAM use with their oncologist, only 52% discussed CAM use with their general practitioner, 30% with their breast surgeon and 24% with their pharmacist. It is unknown why this is the case for this cohort (this survey did not probe this question). Our findings are consistent with a finding of a survey by Xue and colleagues [1] which found 52% did not discuss their CAM use with their doctor, as well as studies within oncology settings which have found that 47–88% of patients did not discuss CAM with their oncologist or doctor [26,38–40]. This finding suggests a need for oncologists, surgeons, general practitioners and pharmacists to be more proactive in talking with patients about CAM use, given its high prevalence in the Australian population and in particular, in subpopulations such as those with cancer. Communication with patients about CAM use should be non-judgemental, respecting the rights of patients to choose to manage their conditions in the manner they wish (consistent with the notion of self-care and basic human rights). A heartening finding of our study was that as a consequence of completion of the survey and use of the IMgateway, almost two thirds indicated they are more likely to discuss their CAM use with their medical practitioner and pharmacist.

Perceptions of safety in relation to concomitant use of pharmaceuticals and ingestible forms of CAM was of interest in our study. Just over 45% of the respondents believed concurrent use of CAMs and pharmaceuticals to be safe (similarly 45.5% were unsure and 9% believe them to be unsafe). Yet, when specifically asked, 73% indicated they were concerned about potential drug-CAM interactions. Such beliefs around safety are not peculiar to cancer patients. In a survey of cardiovascular patients, 45% of CAM users believed that CAM use was safer than taking prescription medications and 47% of CAM users believed there were no interactions between CAMs and prescription medications [41].

The perception of safety is of concern, given that there are many herbs and supplements that can adversely interact with pharmaceuticals, some quite seriously [14,18–20]. For example, a review reports clinically significant interactions between St John's wort and several drugs including cyclosporine, oral contraceptives, anti-retrovirals (indinavir, nevirapine), anticancer drugs (irinotecan, imatinib), cardiovascular medications, benzodiazepines, plus others [42]. The drug warfarin can be potentiated by Chinese herbs dang gui (Angelica sinensis) and danshen (Salvia miltiorrhiza) and by garlic (Allium sativum) [43]. Overlapping substrate specificity in the bio-transformational pathways is the major reason for interactions between drugs and other drugs, foods, and herbs. The key underlying mechanism for pharmacokinetic drug-herb interactions is either induction or inhibition of intestinal and hepatic metabolic enzymes, in particular the CYP enzyme family [43]. However, not all herbs adversely interact with pharmaceuticals- in fact research indicates potential for some to enhance the action of chemotherapeutic agents or enhance recovery from them [44,45]. These important safety issues underscore the need for tools like the IMgateway interactions database for healthcare professionals and for consumer use.

5.1. Going forward

As a result of this study, further refinements will be made to tailor the IMgateway for consumer use. It is intended that further usability studies will be conducted on the updated iteration in the future. In addition, a new Chinese herb-pharmaceutical interactions database (research conducted by University of Western Sydney's NICM Health Research Institute) is currently under development for healthcare professionals and consumers, for release in 2020.

5.2. Commentary on the research approach

This research project was an example of co-design in action, whereby stakeholders (that is, consumers) were integrally involved in the conception, development, interpreting and final reporting process. The initial impetus for the project was provided by a consumer advocate who was part of the research team. Co-design refers to *'the conception or creation of artefacts drawing on a shared vision, social learning and mutual understanding among all key stakeholders'* [46]. This is an important model for conduct of research into healthcare services that is gaining increasing acceptance within the healthcare sector. It takes into account that fact that all involved in the design process may have different perspectives and expectations which should be considered. In the field of social design, co-design is 'a plan or method to do something' which places beneficiaries in positions of power and influence in the design and implementation process [46,47].

The research team was comprised of two BCNA members, a consumer representative, as well as academics across several disciplines. Meetings were held on a regular basis, from conception of the project through to survey design and final report, putting the theory of co-design into action.

The involvement of the BCNA was critical in the research process, from its endorsement of the IMgateway interactions database and research project initially through to its involvement in circulating the email and a Facebook post to members of the Review and Survey Group of the BCNA. In addition, the following organisations also endorsed the research project: Cancer Action Victoria and the Consumers Health Forum of Australia. Endorsement of the research project by the BCNA was instrumental in enabling the successful recruitment of 202 survey participants. The fact that the majority of the qualitative questions were answered in the survey suggests that respondents took the task of giving feedback seriously and engaged in the task at hand.

The Quality and Safety Commission speaks clearly about embedding partnerships in health care. This project clearly is a demonstration of this in action.

5.3. Survey limitations

The IMgateway interactions database was tested out in members of the Review and Survey Group of the BCNA. Respondents were all female. The response rate of 12% for the survey. The survey was conducted in members of the BCNA's Review and Survey Group, which is a group who have indicated willingness to be involved in research projects. It is possible that members may be more motivated than others and may not represent a more general population of women living with breast cancer. It is not known whether those who chose to participate had a higher level of health literacy than those who didn't. Only around 50% of participants completed the scenario- this was somewhat of a surprise, and it is unknown why this was the case. We could not follow up those who didn't complete the scenario to find out why, as it was a

de-identified/anonymous survey. Such a question would have been worth posing. These factors all limit the generalisability of the findings from this cohort.

Responses in terms of behaviour and attitudes around use of ingestible forms of CAM are not necessarily generalisable to males or to other populations. In addition, the survey was conducted in English, and currently the database is only available in English. It is not known if language was a barrier to participating in the survey, nor is it known whether CAM use within different migrant populations within Australia might impact on behaviours around use of ingestible forms of CAM including perceptions of safety. A further limitation was around findings in relation to confidence: whilst we asked participants how confident they felt using the IMgateway, in hindsight it would have been useful to gauge level of confidence before and after using it.

6. Conclusion

The findings of the survey reaffirm findings of other studies in relation to CAM use amongst cancer patients, and communication issues between patients and doctors about CAM use. The concurrent use of ingestible forms of CAM and pharmaceuticals is not without risk and there is a clear need for evidence-based information about potential interactions for consumers so that they may make informed choices and be confident about safety. According to Malby, *'Increasing evidence shows that engaged and informed patients achieve the best health and quality of life. They are more confident and better prepared to manage their condition – and are often more inspired to work with health professionals toward achieving shared health goals'* [48]. The IMgateway interactions database is an important healthcare practitioner tool. With further refinement, a consumer version of IMgateway has the potential to empower and enable consumers to take proactive role in the management of their health, including mitigating potential risks associated with concurrent use of drugs and CAMs, and to feel confident in the choices they make.

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Declarations of Competing Interest

Professor Kylie O'Brien has previously conducted consultancy work for the sponsoring company UnityHealth Pty Ltd. Professor O'Brien and Dr Amber Moore were paid by the sponsoring company UnityHealth Pty Ltd for data analysis and write up of an internal report but not the writing of this journal paper.

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