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# Young people's experiences of a *CDH1* pathogenic variant: Decision-making about gastric cancer risk management

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## ABSTRACT

The most effective option for gastric cancer risk management in individuals with a *CDH1* germline pathogenic or likely pathogenic variant (PV) in Australia is prophylactic total gastrectomy (PTG). There is, however, increasing confidence in endoscopic surveillance as a risk management strategy thus affording individuals with a *CDH1* PV with challenging decisions regarding their gastric cancer risk management. For young people, this decision-making comes at a complex development stage of emerging and young adulthood. This study aims to explore the factors that influence young people's decision-making about their gastric cancer risk management due to a *CDH1* PV. Potential participants were identified and approached through the Parkville Familial Cancer Centre in Melbourne, Australia. Thematic analysis was used to interpret and analyse the data. Qualitative interviews were conducted with 13 people with a *CDH1* PV aged 18 to 39 years, inclusive. The interviews found that participants' familial and shared experiences of cancer and risk management, perceived tolerance of uncertainty, and desire for control over their cancer risk were fundamental in their decision-making about their gastric cancer risk management. The participants' young adult life stage was also deemed particularly important in decisions about the timing of PTG. The findings of this study are vital to inform decisional counseling discussions with this unique population.

**Keywords:** *CDH1*, decision making, hereditary diffuse gastric cancer, prophylactic gastrectomy, psycho-oncology, risk management, surveillance endoscopy

**What is known about this topic:**

Risk management is a multidisciplinary process that requires shared decision making with patients in order to achieve optimal long-term results. Although PTG is still the recommended risk management strategy for *CDH1* PV carriers, increasing confidence in endoscopic surveillance is challenging decision-making.

**What this paper adds to the topic:**

This qualitative study collates the first-ever Australian dataset of the factors influencing decision-making about gastric cancer risk management in young people with a *CDH1* PV.

## INTRODUCTION

Individuals with a *CDH1* germline pathogenic variant (PV) have a significantly increased lifetime risk of diffuse gastric cancer and lobular breast cancer (Blair et al., 2020). The cumulative risk of diffuse gastric cancer for individuals with a *CDH1* PV by age 80 years has been previously reported to be 70% for men and 56% for women (Hansford et al., 2015). More recently, consideration of the ascertainment of *CDH1* PVs and the penetrance of phenotype has resulted in revised estimates of gastric cancer risks of 42% for males and 33% for females (Blair et al., 2020; Lowstuter et al., 2017; Roberts et al., 2019). Given the very poor prognosis associated with diffuse gastric cancer diagnoses, predictive genetic testing is recommended from the age of majority to enable early engagement with cancer risk management strategies (Blair et al., 2020; Koea, Karpeh, & Brennan, 2000).

The most effective, and only, prevention of hereditary diffuse gastric cancer in individuals with a *CDH1* PV is prophylactic total gastrectomy (PTG) (Hebbard et al., 2009; Kaurah et al., 2019; Peacock et al., 2019; Strong et al., 2017). Whilst family history of malignancy does not provide a good marker for timing risk management intervention, clinical guidelines recommend PTG be undertaken in early adulthood, generally between ages 20 and 30 (Roberts et al., 2019; van der Post et al., 2015). However, there is increasing confidence in annual endoscopic surveillance for individuals not yet ready to pursue PTG or for those whose risk of developing gastric cancer is not well defined (Blair et al., 2020). The evidence supporting endoscopy as an effective surveillance tool is conflicting, with multiple studies reporting high incidences of malignant cells found in the resected tissue of individuals who had received a negative pre-PTG biopsy, in addition to technical and other difficulties encountered in subsequent endoscopy procedures (Blair et al., 2020). As such, PTG remains the cornerstone of risk management for individuals with a *CDH1* PV (Blair et al., 2020).

PTG is a significant undertaking and the psychosocial and physical ramifications of the procedure cannot be underestimated. There are a multitude of gastrointestinal symptoms, such as iron-deficiency anaemia, osteoporosis, weight loss and malnutrition, that are associated with PTG and require regular monitoring, sometimes persisting long-term. (Kaurah et al., 2019; Muir, Aronson, Esplen, Pollett, & Swallow, 2016; Peacock

et al., 2019; Strong et al., 2017; Worster et al., 2014). Muir et al., (2016) followed patients (n=13) for 24-months, and suggested that it is the ongoing symptom burden that has the greatest impact on quality-of-life, whilst Hallowell, Lawton, et al. considers the lifestyle adjustments to be the most significant threat to the sense of self of individuals with a *CDH1* PV.

Not all reported outcomes of PTG are negative. Kaurah et al. (2019) concluded that the surgery has no lasting negative impact, and suggested that the psychological benefits of eliminating one's risk of gastric cancer may outweigh the symptom burden. Current practice recommends careful and deliberate discussions with the individual, their family and health professionals, which encompasses risks of PTG, long-term sequelae, and projected outcomes (Blair et al., 2020). Individuals considering prophylactic surgery are also offered decisional counseling prior to surgery, to afford them an opportunity to express concerns that might not have surfaced previously (Blair et al., 2020). Participants of the study by Hallowell, Lawton, et al. (2016) suggested that this pre-surgical counseling allows patients to set more realistic expectations for their recovery, subsequently boosting morale.

***Young people and risk management decision-making***

Young people (aged 18 to 39 years) occupy a transitional and formative life stage, which is characterized by complex psychosocial tasks (Arnett, 2000; Arnett, 2015). The conceptualisation of young adulthood has until recently been described in two life stages as emerging adulthood (18-29 years) and young adulthood (30-39 years) (Arnett 2000 and 2015 refs). More recently, the "established adulthood" life stage (30—45 years) has been proposed to follow emerging adulthood, and more adequately examine and understand this later developmental phase (Mehta, Arnett, Palmer, & Nelson, 2020). Nevertheless, these younger stages of the adult lifespan are characterised by completion of education, forming intimate partnerships, career development, and having and caring for children, whilst exploring and establishing their own identities (Arnett, 2000, Mehta et al., 2020).

It is now recognised that young people are a distinct group within the cancer care setting (Adolescent and Young Adult Oncology Review Group, 2006). However, the needs and

experiences of young people living with an inherited predisposition to cancer have received little research attention (Forbes Shepherd et al., 2018). Only two studies have investigated decision-making regarding risk management for individuals at an increased lifetime risk of gastric cancer (Hallowell, Badger, et al., 2016; Liu, Calzone, Fasaye, & Quillin, 2021). In one of these studies, Hallowell, Badger et al. (2016) included participants aged 19 to 77 years (mean 40 years) and described the younger participants (those aged under 40) as having found some advantages to pursuing PTG earlier in life, such as being physically more resilient and "having fewer social responsibilities", like children, careers, and financial obligations. Conversely, participants were weary of potential study or career disruptions and expressed a desire to remain 'carefree' in their youth (Hallowell, Badger, et al., 2016). A more recent study by Liu et al. (2021) interviewed seven young people aged 18 to 29 years with a *CDH1* PV or likely PV who had not undergone PTG, and all described a lack of readiness for this surgery and a preference to defer this surgery until later in life.

It is clear that for young people with a *CDH1* pathogenic variant, considering and/or undergoing PTG comes at a complex time and has the potential to significantly disrupt normative development trajectories. The decision to pursue PTG is significant and involves weighing up the uncertainty of living with increased risk of gastric cancer with uncertainty regarding surgical outcomes. New and increasing confidence in endoscopic surveillance complicates this further, affording individuals with more choice than they have ever had before (Blair et al., 2020). This study, therefore, aimed to explore what factors are most influential in how young people with a pathogenic *CDH1* variant make decisions about their gastric cancer risk management.

## METHODS

### *Participants*

Ethics approval to conduct this study was obtained from the Human Research Ethics Committee at the Peter MacCallum Cancer Centre (HREC/61486/PMCC-2020). We used Arnett's (2015) description of emerging and young adulthood to define the age range of participants eligible for this study. Therefore, eligible participants were aged 18 to 39 years; had no personal history of cancer; had received a positive predictive genetic

test result for a familial *CDH1* pathogenic or likely pathogenic variant; and had genetic testing and associated risk-management performed in Australia. Individuals who had returned a biopsy result showing a pre-cancerous lesion were eligible to participate. Participants were excluded if they had a history of a psychiatric or a cognitive disorder that may have affected their ability to provide informed consent and those who had undergone testing for a familial pathogenic *CDH1* variant but not yet received their results.

Potential participants were identified from the clinical database at the Parkville Familial Cancer Centre, a conjoint department encompassing two major metropolitan hospitals in Melbourne, Australia: Peter MacCallum Cancer Centre and The Royal Melbourne Hospital. As well as providing genetic counseling and testing, the Parkville Familial Cancer Centre also houses a specialized multidisciplinary risk management clinic with patients attending from across Australia to access screening and discuss PTG. Through this multidisciplinary clinic, all potential participants had met with and discussed risk management options with a gastroenterologist prior to invitation to this study.

Eligible participants were invited by letter or email and reminders and text messages were sent to follow up non-responders. Consent was obtained from participants verbally prior to commencing the interview.

***Data collection***

As a result of the COVID-19 pandemic, all interviews were conducted by author and research assistant, ET, via telephone. An interview schedule was developed based on previous research into young people's cancer risk management decision-making and reviewed by an expert multidisciplinary team of expert researchers and clinicians (Forbes Shepherd et al.,2018). The scheduled was used to guide open-ended questioning, which was further refined as data collection and analysis progress (Supplementary A).

The interviews explored different facets of the participants' experiences and decision-making processes, the physical and psychosocial implications for those who proceeded

with surgery and those who maintain surveillance, and the overall needs of young people with a *CDH1* pathogenic variant.

Interviews were audio-recorded and recordings were transcribed verbatim. Each completed transcript was quality-controlled by listening to the audio and reviewing the transcript for accuracy, and de-identified prior to analysis. Pseudonyms were assigned to each participant and any relatives they mentioned by name during the interview.

### *Data analysis*

A multidisciplinary team of five researchers was involved in data analysis, including genetic counselors (CH and RP), qualitative researchers (LF and ET), and a genetic nurse (MS). Data were collected and analysed concurrently following the basic tenets of thematic analysis (Braun & Clarke, 2006; Braun & Clarke, 2021). An iterative analytical process was employed which began with opening coding of transcripts, or the reduction of data into meaningful units of analysis (Braun & Clarke, 2019). The analysis team met to discuss after each coding round during which comparisons were drawn within and between transcripts (Braun & Clarke, 2019). Data pertaining to risk management decision-making was then further refined into the themes presented in this manuscript. Data was organised, coded and managed via NVivo 12 (QSR International).

## RESULTS

### *Participant characteristics*

Forty-four young people (individuals aged 18 to 39) were identified in the databases as potential participants and 37 of these met eligibility criteria and were invited to participate in the research project. Nineteen individuals (14 females, five males) were interested and responded to the invitation (recruitment rate: 51%) with a resulting 13 (ten females, three males) participating in a telephone interview (total response rate: 35%). Interviews were conducted between March and October 2020 with an average duration of 63 minutes (range 50—82 minutes). With respect to gastric cancer risk management, nine (70%) participants had undergone PTG, two participants had received their genetic test results within 12 months prior to interview and were planning

PTG, and two participants planned to continue endoscopic surveillance for as long as possible. Further participant description can be found in Table 1.

The interviews highlighted three key domains describing the main influences of young peoples' decision-making about their gastric cancer risk management. The themes are: (1) 'Lived and shared experiences of cancer and risk management'; (2) 'Tolerance of uncertainty and taking control'; and (3) 'Young adult life stage, life plans, and the influence on PTG'. The pseudonym, age in years, and chosen gastric cancer risk management option are included after each direct patient quote.

***Lived and shared experiences of cancer and risk management***

Participants' cancer risk perceptions, and subsequently their decision-making about risk management, were greatly influenced by their own lived and familial experiences. For many participants, their familial experience often consisted of a similarly aged family member, or a young or a closely related family member being diagnosed with gastric cancer. This drove their high cancer risk perception leading them to consider PTG as the only option to effectively manage their risk (see Table 2 for illustrative quotes).

*"…I lost two family members to it [gastric cancer] and one of them being very young…having that lived experience…I didn't want to live life with that high risk over my head. It made the decision of having the total gastrectomy…it wasn't a decision it was, in my mind, the only thing that I wanted to do." (Natalie, 31, PTG)*

Familial experiences of cancer created participants' family norms around gastric cancer risk management. These norms provided a reference point, helping shape participants' expectations, and both informing and validating their decision-making through shared familial information. For example, seeing other family members undergo and subsequently recover from PTG was reassuring and influential for participants who were deciding on pursuing the surgery themselves:

*"…the surgeon that I saw, he'd done a lot of us. He'd done my two brothers and two cousins, and a second cousin. And they'd all come out relatively unscathed... So it was good to have people before me to get it done, just to see their stories. That was a huge help, and you can ask lots of questions to all those people." (Sarah, 39, PTG)*

Conversely, Dale, whose pathogenic *CDH1* variant was detected incidentally on his son's amniocentesis, felt his lack of family history and, consequently, lived experience of diffuse gastric cancer greatly influenced his risk management decision-making:

*"No one in our family has ever had it. [I'm not] having it out. I just said to [specialist], we're willing to put our hand up and just get tested with endoscopies…and that's our only way we've been able to monitor it." (Dale, 39, surveillance)*

Emerging from many interviews was the sense of comradery within families with *CDH1* PVs. Participants felt influence over and influenced by their family members in decision-making, as Tessa describes feeling that her decision to undergo PTG was irrevocably linked to her brother's risk management decision-making:

*"And he went first, to make sure that I done it. Because I said to him that I'm not doing it if he doesn't. And yeah, so he's like 'fine', I basically told him I didn't trust him, like me having it done first. I know what he's like, he's very stubborn. So he went first so that I would do it. I reckon if I had have gone first, he might not have done it." (Tessa, 33, PTG)*

Whilst Paige felt reassurance and validation when her brother also chose surveillance over PTG:

*"...I also feel a little bit comforted that [Brother]'s decided to do the same thing as well." (Paige, 21, surveillance)*

That comradery extended to other families with a *CDH1* PV. Although participants frequently reported that their family members were the biggest influences on their decision-making process, online support groups were also considered to be a valuable resource for gathering information. Participants were aware that although no two PTG recovery processes are the same; many reported that hearing from others about their experiences of PTG was helpful in their own decision-making process, particularly for those without a reference point or familial experience of gastric cancer to draw on:

*"I'm all for that kind of stuff [online support groups], especially for people who are only just learning about it and are going to go through it... If I was a person newly*

*diagnosed, having information from people who have been through it and stuff like that would certainly have definitely helped." (Tessa, 33, PTG)*

***Tolerance of uncertainty and taking control***

Many understood and described the complexity of endoscopic surveillance and there were mixed feelings amongst the participants about their confidence in the efficacy of surveillance. Some participants appeared more tolerant of the uncertainty that accompanied screening and biopsy results than others, which was particularly relevant in their decision-making surrounding gastric cancer risk management.

Participants who reported feelings of stress and anxiety both prior to endoscopy surveillance and whilst waiting for biopsy results felt this experience drove their decision-making toward PTG. Leah explained how underlying feelings of anxiety often remained, even after negative biopsy results, and her intolerance of this uncertainty drove her decision to pursue PTG:

*"there's a lot of stomach to cover and they only take like real small, small amounts…one day you could be fine, the next, you couldn't…I felt really uneasy about it and was thinking of just taking the next step anyway and just remove the problem altogether." (Leah, 26, PTG)*

Conversely, Paige and Dale, the participants electing to continue screening, appeared to be more tolerant of uncertainty and had trust in both the surveillance method and in the health professionals themselves, thus contributing to their decision to continue surveillance until PTG became necessary:

*"You are probably looking for a needle in the haystack a bit, because it is hard. You can't just biopsy the whole stomach. So it's a bit of pot luck. But I'm confident enough…that [specialist] knows what he's looking for." (Dale, 39, surveillance)*

Both Abby and Thomas, who were the two participants planning PTG, felt that a desire to maintain a level of control over their cancer risk also influenced their decision to pursue PTG in preference to surveillance:

*"like at this point, I'm still in control, I'm still able to decide what happens. Whereas if you wait until you've got cancer, you're not." (Abby, 36, planning PTG)*

For Molly, however, her choice about when to have PTG was taken away by the necessity to undergo gastrectomy. A positive biopsy at the age of 19 took away her control and negated her decision-making about her gastric cancer risk management, leaving her shocked and angry:

*"[PTG] was going to happen when I was 24, so I had a whole plan of what my life was going to be. So when the first one [biopsy] came back clear, I was pretty happy, I was on track. And then the second one came back, and the [pre-cancerous legion] was there, it did kind of shock me a bit. And I was kind of angry." (Molly, 21, PTG)*

***Young adult life stage, life plans, and the influence on PTG***

Most participants felt that the most complicating factor in their decision-making to pursue PTG was the life stage they were in and the subsequent concern that PTG would interfere with or restrict these and future plans during their young adulthood. Participants reflected on the difficulty of deciding on the timing of the procedure, often making decisions to defer their PTG until a seemingly more appropriate time that fit with their life stage.

*"... I was thinking about like all the knock-on effects (after having PTG)... like I wouldn't be with... the friendship groups that I'd formed at (university) anymore… it'd push back my mid-twenties timeline plan a little bit…just like all of the effects of having to take a break from (university) and everything for a little while and recover." (Paige, 21, surveillance)*

The formative experience of young adulthood, including partnering, education, travelling, work and income, social experiences, and having a young family were all identified as complicating factors for participants (see Table 3). Sarah described her concern that she would not be able to keep up with her kids after having PTG:

*"I just really thought that I'd be really lethargic and not have enough energy to run after my kids, and that was the one reason why I left it so long. I didn't want to be a*

*boring mum who sat on the couch on the weekend and relaxed because she was so tired, and Dad gets to take them out all the time." (Sarah, 39, PTG)*

In a similar vein, Dale's concern about the impact of PTG on his active and social young adult lifestyle were further reasons for maintaining surveillance rather than PTG.

*"You're just like, 'how is this active lifestyle going to [go] with no stomach? How do I still go snow skiing and water skiing and play football and do all these things? And how do I manage food?'... I think it's just the whole mindset also. At first it gets you down. How am I going to live my lifestyle that I'm used to?" (Dale, 39, Surveillance)*

Participants also identified advantages of undergoing PTG during young adulthood, particularly feeling that their good health and fitness would be an advantage in their recovery from PTG:

*"Everyone just kept saying like 'you're young, you're fit, you'll push through it easily, like you'll be fine' and then... yeah it kind of helped me make up my mind a bit…with them saying it because you are, you're young and you bounce back from things a lot quicker... So yeah it made me feel a little bit easier about it but yeah it was still a hard decision to make." (Leah, 26, PTG)**

Others were considering their future life stages and felt that undergoing PTG would help them to move on to the next part of their life. Some, like Mia, identified that by acting prophylactically during their young adulthood, this meant going on to live the majority of their lives without the burden of gastric cancer,

*"…People don't really get [it] especially when you're young. They think you're gonna ruin your life… I wanted to make everyone understand that if I do it... like I'm doing it…[to] like set and forget. You don't have to worry about it [gastric cancer risk]." (Mia, 26, PTG)*

For the participants yet to have children, like Liz, they often referenced the desire to have children in the future as a factor in their decision-making:

*"Once I realised that I did want to have children and had a different life with this new partner and stuff I was like I can't keep doing what I'm doing, I need to make a change.*

*So that had to happen to for me to accept that I needed to do something [have PTG]. (Liz, 34, PTG)*

## DISCUSSION

The aim of this study was to investigate how young people aged 18 to 39 years old with a *CDH1* PV make decisions about their hereditary diffuse gastric cancer risk management and exploring the factors most influential in their decision-making. Understanding decision-making in this age range is particularly relevant given the very high gastric cancer risk for individuals with a *CDH1* PV and average age of diffuse gastric onset estimated to be under the age of 40 (Guildford et al., 1998). This is only the second study to exclusively explore the experiences of young people with a *CDH1* PV, and the only to include individuals who have undergone PTG and those actively considering PTG, to gain an understanding of the influential factors in their decision-making.

Given the familial nature of *CDH1* PVs, it was somewhat unsurprising that decision-making surrounding gastric cancer risk management was greatly influenced by participants' lived experiences. For some, the decision to undergo PTG was simple; their lived and familial experience of gastric cancer and gastric cancer-related deaths caused a high degree of risk-aversion and PTG was the only option they considered. This finding is incongruent with recently published findings in a similarly aged cohort in the United States of America, whereby the majority of their participants did not feel ready to pursue PTG even in the setting of lived or familial experience (Liu et al., 2021).

Participants reported wanting to change the family norm of losing family members to gastric cancer, and this became a large motivating factor for PTG. There was also a large sense of validation and reassurance for participants who had had discussions with or had shared experiences with family members who had undergone PTG with minimal consequences. The pertinent decision for these participants, therefore, was not if but when to pursue PTG. For others, however, the reassurance that other members of their family had chosen surveillance via endoscopy with biopsy, or having no experience of gastric cancer in their family, were instrumental factors that also led to their decision to

forgo PTG. This is not a new concept, as the influence of the family norm is a widely recognised phenomenon for young people experiencing genetic testing across a spectrum of adult-onset conditions, including familial cancer (Forbes Shepherd et al., 2018; Werner-Lin & Gardner, 2009). These findings also concur with studies in older cohorts that include individuals with a *CDH1* PV, who report that family history of disease, particularly gastric cancer illness and/or death of family members, as powerful incentives for surgery (Hallowell, Badger, et al., 2016; Lynch et al., 2008; McGarragle et al., 2020).

In addition to being influenced by their lived and shared experiences, the young participants of this study also felt strong ties to their extended family members and invested in their risk management decision-making journeys. This reciprocity stemmed from a sense of familial responsibility to give back the support they received from family members, by being a resource for others undergoing their own decision-making. The authors speculate that the rarity of *CDH1* PVs combined with the contrasting information about PTG and its outcomes motivated participants to share their experiences and journeys as their family shared with them. This also extended to support through online platforms.

A previous study investigating individuals with a *CDH1* PV have found that many (approximately half ) decided to undergo PTG after receiving a positive screening result (Hallowell, Badger, et al., 2016). With the exception of one participant (Molly), this was not seen as a trigger point in this study's participants who were planning or had undergone PTG at the time of interview, with all individuals deciding prophylactically to undergo the surgery to manage their gastric cancer risk. Individuals felt a sense of wanting control over their gastric cancer risk through PTG, the procedure providing an effective reprieve from the cancer risk burden. This desire for control over cancer risks has also been seen in young women at risk for hereditary breast and ovarian cancer (Hamilton, Williams, Bowers, & Calzone, 2009).

When interviewed, participants often quoted an intolerance of uncertainty and concerns about the efficacy of surveillance as influential in their surgical decisions. These feelings of anxiety surrounding endoscopy and biopsy as an effective screening tool for gastric cancer have been reported before (Hallowell, Badger, et al., 2016; McGarragle et

al., 2020). These opinions contrasted heavily with those of the participants who had chosen surveillance to manage their gastric cancer risk. These participants understood the nuances and challenges of the screening procedure; however they also described a sense of trust in the healthcare providers. The authors speculate whether the increasing confidence in endoscopic surveillance in recent years has permitted health professionals to safely offer this as a risk management option, particularly as this increase in trust in surveillance is reflected in two additional studies published within the last year (Liu et al., 2021; McGarragle et al., 2020). The downstream effect of this alters the implications for and discussions with the current patients of clinical genetics services when considering the risk management options for *CDH1* PV carriers.

Finally, the results also show that consideration of current and future life stage was an important influence on young peoples' decision-making, and was often a more difficult decision for some who had perceived PTG as the only option suitable for them. The formative experiences of young adulthood, including financial, travel, social, familial, educational and career responsibilities, were identified as driving factors for participants when deciding on a suitable time for gastrectomy, a finding echoed amongst the younger participants of a mixed methods study conducted by McGarragle et al. (2020) and a report by Lynch et al. (2008).

The role of either being or planning to be a parent was a strong influence on the timing of gastrectomy for many participants. Although for participants in this study, the sense of family responsibility encouraged them to pursue PTG, another study contrastingly reported that concerns regarding caregiving abilities post-surgery led to individuals deciding to delay or decline PTG (McGarragle et al., 2020).

Regardless, the vast majority of the participants in this study had decided, planned and proceeded with gastrectomy within their young adulthood, a finding that contrasts with that of Hallowell, Badger, et al. (2016) and Liu et al. (2021) who reported that most participants aged 40 years or younger opted to continue surveillance and postpone surgery until they felt more prepared. Further research is necessary to determine what is unique about the Australian cohort of young adults that encourages their readiness for PTG during this age period.

## Study limitations

This study is the second to exclusively capture the experiences and gastric cancer risk management decision-making of young people with a *CDH1* PV. The main strength of the study is the snapshot of experiences across various ages and life stages of the participants aged 18 to 39 years. Participants were at different points in their decision-making journey, allowing exploration of the divergent and dynamic experiences of this population, whilst highlighting the importance of further study and longitudinal follow up for *CDH1* PV carriers. Whilst this study explored young people's experiences collectively, future research into young *CDH1* PV carriers is encouraged to further elucidate potential differences within this age range. In addition, the majority of participants in this study had undergone PTG and therefore were reflecting on their decision-making journey through the lens of hindsight. Only two participants were actively considering PTG at the time of the study and did not have the influence of their post-operative outcomes in their decision-making. Recruitment for interviews began at the beginning of the COVID-19 global pandemic, and it is difficult to determine how this impacted on the response rate, and the authors appreciate the perceived challenges for potential participants to participate during an unprecedented and emotional time.

The participants of this study were recruited through a metropolitan, cancer risk management clinic staffed by genetics and gastroenterology specialists, and therefore receive access to the latest evidence-based information. This may contrast to other individuals with a *CDH1* PV who may not receive the same level of specialised support and resources to inform their gastric cancer decision-making, and their experiences were not represented in this study.

Finally, it is clear that the impact of PTG on long-term quality-of-life requires further study. The authors and participants of this study support the development of a longitudinal, prospective cohort study to understand further the clinical and psychosocial outcomes associated with gastrectomy.

## Clinical Implications

The findings from this study can inform clinical discussions with people aged 18 to 39 years with a *CDH1* PV about cancer risk management and facilitate decision-making. Given the clear influence of lived and familial experience on participants' decision-making, it is recommended that young people speak to their family members and perhaps other families to help them navigate the decision-making process and receive ongoing support throughout the process. In addition, health professionals are encouraged to prompt young people to consider their current life stage and future life plans to explore the potential for competing interests that might influence their decision-making. Irrespective of young people's choice of gastric cancer risk management, it is imperative that they receive in-depth discussions from well-informed health professionals to support their decision-making. Health professionals must be aware of the nuances in the process of risk management decision-making in young adults and the importance of individualising and youth-friendly decisional counseling and care.

## CONCLUSION

In conclusion, this study has identified a number of significant influences on the decision-making surrounding gastric cancer risk management in young people with *CDH1* PVs. These individuals face a very high risk of gastric cancer over their lifetime, and are faced with two options to manage this risk; surveillance via endoscopy with multiple biopsies, or PTG. This study found that an individual's family experience of gastric cancer is fundamental in their cancer risk perception as well as their decision-making surrounding PTG. A motivating factor for PTG was having a sense of control over this high risk, and reducing the uncertainty that comes with annual surveillance. People aged 18 to 39 years undergo dynamic life changes during this time period, and their current life stage and future plans must be considered in a discussion surrounding when to pursue PTG. Overall, it is vital that health professionals involved in gastric cancer risk management recognise and acknowledge these influences on young adults' decision-making in order to provide individualised support and care in this process. The findings from this study can inform these clinical discussions with young adults about gastric cancer risk management and advise and support their informed decision-making. This preliminary study also provides the foundation for future research, particularly

informing the development of a longitudinal, prospective cohort study to fully elucidate the clinical and psychosocial outcomes associated with gastrectomy.

## Author contributions

All authors contributed substantially to the design of this study. Erin Tutty was responsible for the acquisition, management, and statistical analysis of data. All authors contributed to the interpretation of data. Cass Hoskins wrote the original manuscript draft, and all authors were involved with the revision and editing of the manuscript. All authors agree to be accountable for all aspects of the work and ensuring that questions related to the accuracy and integrity of the work are appropriately investigated and resolved.

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## Compliance with Ethical Standards

Authors CH, ET, RP, MS, AB, and LF declare that they have no conflict of interest.

## Human Studies and Informed Consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

## Animal Studies

No animal studies were carried out by the authors for this article.

## Data Availability Statement

Research data are not shared because data are qualitative interviews that may contain identifiable information

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**Table 1. Participant description**

| Characteristics | |
|---|---|
| Age at interview (years) | n=13 |
| Mean | 32 |
| Range | 21—39 |
| Age distribution | |
| Aged 18-29 | 4 |
| Aged 30-39 | 9 |
| Age at genetic testing (years) | |
| Mean | 27 |
| Range | 18—37 |
| Age distribution | |
| Aged 18-29 | 7 |
| Aged 30-39 | 6 |
| Age at PTG (years) | n=9 |
| Mean | 27 |
| Range | 19—39 |
| Age distribution | |
| Aged 18-29 | 6 |
| Aged 30-39 | 3 |
| Time since receipt of genetic test result (years) | n=13 |
| Mean | 4 |
| Range | 0-13 |
| | **n=13 (%)** |
| **Relationship status** | |
| Married/de-facto | 10 (77) |

| | |
|---|---|
| Single | 3 (23) |
| Children (yes) | 4 (31) |
| **Residential location** | |
| Metropolitan | 5 (38) |
| Regional | 3 (23) |
| Interstate[1] | 5 (38) |

[1] These participants travelled to metropolitan Melbourne to access risk-management

**Table 2: Quotes illustrating the influence of participants' lived and shared experiences of cancer and risk management**

| Quote # | Participant | Quote |
|---|---|---|
| 1 | Leah, 26, PTG | *"…my sister's only four and a half years older than me* and to find *it [cancer] was in her stomach… she was kind* of like my kick-starter to wanting to jump on the bandwagon and just get the stomach taken out *because…only four and a half years difference you just* |

| | | |
|---|---|---|
| | | *never know what could happen."* |
| 2 | Nick, 39, PTG | *"...I'd seen like my aunty, she was only 30 years old, too,* when she died. And mum cared for her all the way through and I seen her every day and I seen how she battled it and what she had to go through, and that makes your mind up. Yeah, the choice was pretty easy as well when I think about *dying from it…."* |
| 3 | Thomas, 37, planning PTG | *"Essentially only the people that had surgery in the past* year survived. So out of these eight people that were found *positive, three survived. The other five died…I'd rather take care of it right now, where I can fix it, let's say."* |

**Table 3: Quotes illustrating young adulthood lifestyle and experiences are important in the timing of PTG**

| Quote # | Participant | Quote |
|---|---|---|
| 1 | Nick, 39, PTG | "the biggest factor is not knowing after I had my stomach |

| | | |
|---|---|---|
| | | *out whether I could get back to work…. And being the main money earner in the house…not knowing how I was* going to cope after that or if I was going to be on the dole or on the pension for the rest of *my life… That was, yeah,* sort of a stressful time for me as well." |
| 2 | Emma, 36, PTG | *"My now husband and I had gotten engaged maybe 12* months prior. I guess it was just a phase in my life where I wanted to travel a little bit, so I just wanted to do that, and I guess it was just that unknown of how different life would *be afterwards."* |
| 3 | Natalie, 31, PTG | *"…having a young, a very young family as well that was* something that was that played hugely on my mind in all of my decisions in relation to the CDH1 gene. |