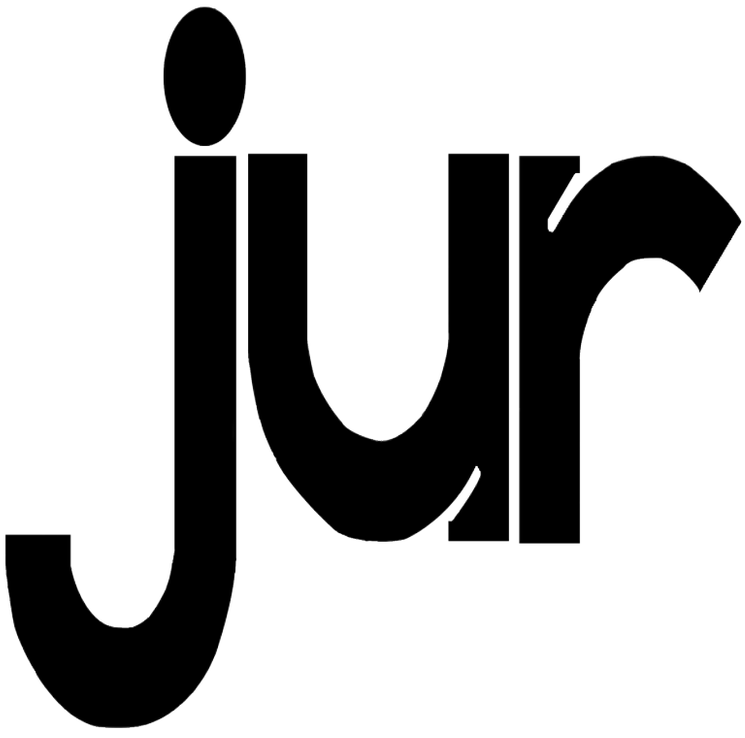
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The *Journal of Undergraduate Research (jur*) is dedicated to providing the student body with intellectual perspectives from various academic disciplines. *jur* serves as a forum for the presentation of original research thereby encouraging the pursuit of significant scholarly endeavors.

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From the Editors

On a fundamental level, the motivation behind all academic research stems from an interest in approaching some unknown and growing to understand it. The methods one employs for such an undertaking differ from field to field, but they are all united in their most basic structure. Researchers work for years to develop the background knowledge of their given field; being educated to the point where unanswered questions become unearthed and the edge of understanding becomes clear. This knowledge then becomes the foothold for new insights. They take these facts and rearrange them in new ways, mixing up the pieces of the puzzle so as to come to a new understanding of some unique phenomenon. It is a difficult process filled with doubt and dead-ends, yet it is one that helps push our society forward to new levels of understanding into our world.

So, for an undergraduate even to take on such an endeavor, let alone arrive at some unique insight, is an impressive feat. Becoming an apt researcher, in any academic field, requires years of practice to refine one's skills, and getting such an early jump on this course is a great think. But beyond that, the simple act of engaging with new ideas in an independent fashion adds a new dimension to one's education and is an integral part of growing as a thinker. Therefore, the Journal of Undergraduate Research is proud to present our Spring 2014 issue. It contains articles in a number of different fields, including Biology, Anthropology, Film and Media Studies, English, and Political Science, all of which are the result of undergraduates approaching different questions in new ways. We hope that you enjoy the end result of their hard work.

Sincerely,

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About the Journal

The Journal of Undergraduate Research, Volume 12, Issue 2, Spring 2014 was assembled on a Windows 8 PC using Adobe InDesign CS6. Graphics were produced using Adobe Photoshop CS6 and Adobe Illustrator CS6. Microsoft Office:was used for text editing and review. Fonts used included Arial, Symbol (for Greek characters), and Garamond. This journal was printed and perfect bound by Canfield & Tack of Rochester, NY.

"Blessing and Burden": Negotiating the Hemodialysis Experience

Alysha Alani, 2014
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This exploratory study aims to examine the hemodialysis experience for patients with a focus on exploring perceptions of burden and dependence as well as kinship relations and social support systems. Through semi-structured ethnographic interviews with patients, the author describes how people define and assess the "burden" of dialysis, how they cope with the reality of being dependent on dialysis for an indefinite amount of time, the challenges they face daily, the social support systems available to them, and how kinship roles and relationships change because of dialysis. Understanding and empathizing with dialysis patients is key to designing effective and sensitive interventions to help ease the challenges and burden of treatment on patients and caregivers.

When a patient is diagnosed with end-stage renal disease (ESRD), he or she is often put on hemodialysis: a treatment that filters the blood as a functioning kidney would. Patients with ESRD are treated with a form of dialysis, which is seen as a temporary solution, with the ultimate goal being kidney transplantation for those who are determined to be viable candidates. Patients are bound to their dialysis machines for 3 to 4 hours, 2 to 3 times a week, which usually disrupts their normal life and activities, including work[1]. Many are not able to support themselves financially or physically as the treatment takes a heavy toll on the body. Patients are likely to develop anemia, generalized infections, neurological damage, gastrointestinal bleeding, chronic headache, and bone disease with persistent treatment. In addition, regulatory hormones produced by the organ are not supplied by the machine.[2]

Previous studies have suggested that the stress of being dependent on the machine and treatment schedule can lead to depression among some patients. A study from 2011 found that five percent of dialysis patients commit suicide, and seven percent commit what is known as "passive suicide" by purposefully straying from their diets or dropping out of treatment programs.[3] The indefinite nature of dialysis and the uncertainty of receiving a kidney transplant can also contribute to stress and depression.

Other studies have shown that depression and stress not only affect dialysis patients, but also their caregivers. In a 2011 cross-sectional study published in the journal Nephrology Dialysis Transplantation, 236 participants reported having unpaid caregivers and over 50% felt these caregivers were overextended.[3] This study also showed that increased self-perceived burden of care was positively associated with worse depression and quality of life.

Introduction

"I always say I hate the sight of blood, especially mine. It took me a long time to even just to get used to this, the idea, what they were doing to me. Pretty amazing." Patricia[4] has a soft voice, so soft that the recording program on my laptop barely picks it up between the beeping of the dialysis machine, the conversations between technicians, and my shuffling of papers. I'm seated on one of those round, pleather stools without a back, while she's in a beige, pleather armchair across from me. Though I've never been to this particular outpatient dialysis center before[5], the lingering scent in the air is familiar – a mix of vinegar for disinfecting, gauze and plastic surgical tape, and recycled air.

I had spent time at a dialysis facility off and on in 2011 when my mother was receiving treatment. She would drive to the center on her own, three times a week, in the early afternoon. On some days I would pick her up on my way home from school, and this is where I met Patricia. She had the same treatment time slot as my mom and sat in the chair next to her. While it became routine for me – to sit in a chair by her as the clock on the dialysis machine counted down the last few minutes like a timer, to apply pressure to her fistula to stop the bleeding, to gather her things while she stepped on the scale and reported her weight back to the technician – it wasn't until after my mom received a transplant in January of 2012 that I realized how big of an issue dialysis was for her, for me, and for our family.

If you were new to the field of kidney disease and dialysis, you might start with a simple Google search. The National Kidney Foundation (NKF) is a reputable source for kidney health information and provides some basics on what dialysis is like on its webpage.[6] One frequently-asked-questions type of subpage caught my attention:

"Do dialysis patients feel normal?"

Many patients live normal lives except for the time needed for treatments.

Dialysis usually makes you feel better because it helps many of the problems caused by kidney failure. You and your family will need time to get used to dialysis.

From my own personal experience and from my current research, I believe the answers provided, like this one are oversimplified and deceptive. In this paper, I want to convey what life is really like for hemodialysis patients – how people cope with the reality of being dependent on dialysis for an indefinite amount of time, the challenges they face daily, the social support systems available (or unavailable) to them, and how kinship roles and relationships change because of dialysis. I began looking at the topic of burden of care and soon realized that I was imposing my own definition of "burden" and so instead sought a broader approach to the challenges patients face, allowing my informants to teach me what and how dialysis affects daily lives.

Purpose

Prior studies have argued that caregiver burden has a tangible effect on the health of the patient, but they have left the concept of "caregiver burden" unexamined. These studies have also indicated that high levels of stress may lead to suicide and depression in a small percentage of patients. However, these studies have not explored the ways that the majority of patients adjust and adapt to this new lifestyle. How do patients cope with these changes in their lifestyles and in their intimate relationships with the caregivers that help them manage the treatment and its side effects?

The purpose of this research study is to study the qualitative experience of patients undergoing hemodialysis treatments for end stage renal disease. How do they experience and cope with the stress of treatment, and what constitutes "burden of care" from the points of view of the caregiver and patient? How does the idea of "burden" differ depending on the kinship relations between the patient and caregiver, and how do kinship relations change (if at all) while a patient is undergoing treatment?

Methodology

Between May and November 2013, I conducted four ethnographic interviews with patients.[7] I tried to make these interviews as dialogic as possible by sharing my own experiences with a family member on dialysis. To ensure confidentiality, I gained verbal consent and de-identified individuals in this final report. In addition, I conducted library research to explore the current literature on this topic and used personal family experience to inform my interview questions and interactions with my informants.

Four patients in the greater Rochester, NY area participated voluntarily and were not financially compensated. There were no enrollment restrictions based on gender, age, or racial and ethnic origin. Any adults who are currently receiving or who have received hemodialysis as a treatment for end stage renal disease in the past and their self-defined, unpaid caregivers (family, friends, etc.) were eligible for the study.

The primary research method was ethnographic interviews. The snowball method of getting in contact with subjects was used starting with personal contacts. These contacts recruited future subjects from their acquaintances. In addition, I approached potential subjects directly and handed out information letters at events hosted by the non-profit organization, Kidney Cares of Western New York. Interviews were conducted in person (at a time and location decided by the subject) and audiotaped.

I am entering into this research as an undergraduate that has never experienced any chronic medical conditions firsthand, let alone been on dialysis. I am influenced by my family's own experiences with dialysis as disclosed above. While I tried to stay away from using pre-defined terms like "burden of care," the preliminary research studies I had read prior to starting this project focused heavily on these terms and forced me to quantitatively measure them. I hope to contribute some qualitative analysis to the current discourse to express the human side of dialysis and those affected by it, with emphasis on the influence of empathy and understanding on future interventions and patient services. This is merely a preliminary study limited by the constraints of time, access to patients, and access to transportation among other factors. Further research can and should be done; possible topics include how kinship and caregiving roles change in the family setting and in the patient's perception of illness.[8]

Ethnographic Narrative

Patricia Williams, 73

"Well. I think for me it's a blessing. Where would I be if I wasn't here?"

This is how Patricia responded when I asked her to describe dialysis. Not a blessing in disguise, not a blessing at times, just a blessing.

Patricia has been on dialysis since March of 2010 when her kidneys failed due to complications with diabetes. The first time she experienced the treatment, she did not know much about the process or anyone on receiving it beyond the pamphlet her nephrologist provided and a couple of visits with a friend so she could choose a center. Nothing, certainly not a tour of a dialysis center, can prepare you for what it is like, and without knowing what to expect, dialysis can be a scary process. "Nobody ever did give me the whole case scenario. It's okay, I'm not someone that needs to be practicing medicine, that's why they get paid the big bucks..."

Now, at 73 years old, she has come to terms with this treatment – its limitations and its benefits. On a typical dialysis day, that is every Tuesday, Thursday, and Saturday, you'll find her starting treatment in the basement of a rehabilitation center in a Rochester suburb at around 1:30 pm. Her weight, blood pressure, and temperature are taken before starting.

After a surgical procedure to create a graft or a fistula, usually in the upper arm, the dialysis machine connects to the body via two needles, one for the blood coming out and the second for the "cleaned" blood to re-enter the body. It's not a painless process as the NKF website suggests:

You may have some discomfort when the needles are put into your fistula or graft, but most patients have no other problems. The dialysis treatment itself is painless...[9].

At first Patricia tells me, she doesn't feel "anything" during dialysis, but I soon find out it wasn't always that way and she had simply gotten used to the "sticks," or the process of inserting the needles into the graft. Since the graft is deeper, and not just under the skin, it can be difficult for the technician to insert a needle into it

on first try. The graft can shift, it's needle must be at the correct angle, and most importantly, every person's is different. There are numbing creams and sprays available to dull the pain of needle insertion, but Patricia tells me that is not an option for her:

No, I don't use any of that. Well the cream, I used but then you have to wrap your arm in Saran wrap[10] and that's kind of hard to do by yourself… And the spray stuff…that's expensive. It's not covered by your insurance. But after awhile, when they get it right, it doesn't hurt at all. Poking around sometimes that gets a little…I just close my eyes and sit there. Once they get to know you, you're okay. Sometimes it's sore. Sometimes…(beep of dialysis machine) …my arm is black and blue and times they don't get it exactly right (beep) …I've been lucky I don't have to go for a fistulogram which isn't pleasant.

Her treatment usually lasts around three hours during which Patricia enjoys watching the cooking channel, a self-proclaimed addiction. After treatment the two needles are replaced with gauze, surgical tape, and a clamp-like plastic clip that applies pressure on her arm to stop the bleeding. After 15 to 30 minutes, the clips are removed and more tape is applied to ensure no blood escapes. Next, Patricia steps on the scale once again and wheels her walker to the elevator, which takes her to the first floor lobby, where she waits for her medical transport bus home.

Lifestyle Changes

We've been talking for over half an hour now, and I begin to wonder if she's getting tired as the technician comes in to check Patricia's temperature with an oral thermometer. I pause mid-question and tell her to take her time assuming she would want a break, but to my surprise she says through a semi-closed mouth, "this doesn't stop me!" It's nice to know Patricia retains a sense of humor. That persevering attitude is as valued in our contemporary society as independence. However, Patricia has had to surrender some of her independence, like her car.

…driving even to turn your head and look out the back window, it wasn't easy. I wanted to end on a happy note, I didn't want to end up hurting anyone or myself, and I didn't want my kids to take away my keys! I wanted to make that decision on my own, and I think they're happy with it.

I see a lot of people, older than I am, that are in much better shape. Sometimes I get upset but that's the way it is. And people 88 years old doing wonderful things, you know? I think my health has a lot to do with. It changes your lifestyle. I gave up driving, can't come and go like I'd like to. You give all of that stuff up. And that's hard.

She now relies on Lift Line, a service provided by the city of Rochester for those with a disability that prevents use of Regional Transport Authority's fixed-route buses; eligibility is determined through the Americans with Disabilities Act application process. To get home after a tiring treatment, she has to wait a couple of hours for her ride: "But, it's okay. I read a good book. It's pleasant sitting up there, and I just wait it out."

The list of lifestyle changes grows longer.[11] In addition to aging ("Growing old is not the golden years!"), Patricia faces high blood pressure, diabetes, arthritis, and cataracts requiring multiple ocular surgeries which have helped but still left her with less than 20/20 vision. She reflects, "This is as good as it's going to get." While certain conditions, like diabetes, preceded her kidney failure, there is no doubt that they are affected by and in turn affect her dialysis treatments. Her energy level, especially, has been altered; dialysis is known to be an exhausting process.

Just like kind of a long day. I'm older now, and I don't have as much energy as I used to, of course…My lifestyle is very simple, very quiet. It's not a lot to take care of…Dialysis is rough and tires me. And you notice the difference on the odd days[12]…You have to watch…your diet and it's just life (beep).

Despite the side effects, Patricia is grateful: "I'd never thought I'd be happy about coming to dialysis. They're nice people." Her current clinic is a small center with only 5 stations compared to her last one, which had 30 stations (more than the Monroe County average of 18). Patricia explicitly expressed her satisfaction with her current center throughout our time together: "And they're all busy over there [at the old center], there's not time for the little extras that we have here, just the niceties…If you have to do something, I'd rather be happy about it."

Patricia's nephrologist said she would make an excellent candidate for a transplant. In the time I spent with Patricia, it was common for her to mention the status quo and a lack of control over it, the "normal" course of events indicated by the repetition of phrases like "it's just life" or "that's the way life is" and most noticeably, her decision to turn down the opportunity for a transplant.

I'm sure there's someone younger than I am that could use it more... there are younger much younger people who have kids and families that you know would probably be more receptive. When it's my time, it's my time in this stage of the game.

She seemed to justify her limitations by stating, multiple times, that she was not a medical professional and therefore did not need to know the details of her condition and treatment.

I'm not trying to be a practicing physician so I don't ask any questions! I always tell the dentist when he tries to put me on the TV and show me what he's doing. If I wanted to be a dentist, I would have done it. Wake me when it's over.

This aligns with her view that other patients in her position are also uninformed:

[Another patient's] daughter is very aggressive; she wanted to know what was going on and who was dealing with her dad and all that. She's just on top of everything. How much he understands, I don't know… I don't think anybody is informed but if you ask, they will try to help you. But how do you know what to ask?

It also seems like understanding it from a medical perspective and coming to terms with it physically and emotionally are two different things:

I couldn't look at the machine for months. I didn't know anything from it. I just bury my head in the ground, go ahead and do what you want to do. Wake me when it's over.

I realize now that coping with the reality of being on dialysis isn't a one-time action; it is constant negotiation and re-negotiation, and there are multiple perspectives. Coming to terms with and understanding the physiological process did not follow the same timeline as coming to terms with and understanding the emotional

side effects.

Support Systems

Apart from her cats, Patricia has been living alone since her husband passed away in 2010. She recently had surgery on her foot, and her 22-year-old grandson Paul is staying with her and helping her take care of herself.

He's my caregiver now after my surgery…I say he should go into the medical field. He does as nice a job of wrapping my feet as the nurses do. I mean he's not squeamish…He cleans it, socks it.

Paul is the oldest of Patricia's 8 grandchildren, 4 of whom are local. While day to day she is on her own, Patricia counts on her children to help her with chores. After church on Sundays, she goes grocery shopping with her daughter. "If I need anything in between, the big heavy stuff, my son lives [in a nearby suburb] so he'll pick up medications or a big bag of cat food."

When it comes to medical care, Patricia considers both friends as well as family to be caregivers. While she seems genuinely touched that they're present: "They've been so insistent on asking, that they care enough to do that," I sense some hesitation when she takes about her children's level of involvement in her care.

It's nice if everybody was informed. We have a little bit of a jump on that because my daughter-in-law is a nurse practitioner in orthopedics, but they know a lot, and she can help [my son] understand it. My daughter she doesn't want to know anything about it. She has no bedside manner. I hope it doesn't come back to bite her. The idea of all of it; they're all very understanding, they don't give me a hard time about it if I decide I don't want to do something or go somewhere because I'm tired…They have to be really understanding of people's feelings. I don't think you want to be babied, but it is nice for people to understand that you know, you don't always feel like jumping in with both feet…

There seems to be a delicate balance among her caregivers between involvement (but not infantilizing), understanding (of Patricia's physical and emotional limits), and empathy (without having experienced dialysis themselves). She prefers her son to accompany her to doctor's appointments because of his wife's medical background, as mentioned above, but sometimes a friend takes Patricia. "My other friend who goes to the doctors with me, she just, she actually sounds happy if you ask her to do that…" Patricia makes a special effort to make these trips enjoyable and convenient for people by booking multiple appointments in a day and treating her son or a friend to lunch or a "fun" stop in between.

A friend who loves the garden store, I miss not being able to jump in the car and take a trip to the nursery, so we do those things [doctors appointments and outings] together, hopefully a little fun for her too…They're always asking. In fact, she said let's just plan for once a month.

When you do those things, it gives you time to spend with friends who might not have that time…you get to your doctor's appointment and you have time to chew the fat, women always love to talk! It's turned out to be a good experience. That's what it is.

Many of Patricia's friends are also part of her church community, which as a whole is another great support system for her. She has been a member of Rochester's Pinnacle Lutheran Church for the last 50 years. The congregation there is aware of her kidney failure and was helpful in taking turns coordinating rides and meals during her first 3 months of dialysis.

Self-Burden

Beneath the cheery disposition, there are days that take extra effort for Patricia to get going: "Some days it's not always easy, some days I hardly want to get out of the [dialysis] chair and do anything, but I push myself." I sense there is a certain responsibility, or burden, on Patricia. For example, she must make these trips, chores, and tasks enjoyable for her caregiver. They are "good experiences," as long as she makes them so:

[re: errands and trips to the doctor] The only person that's going to make it unpleasant is me…

It's interesting, a lot of my friends try to compensate, try to understand what I was going through, but a lot of it has to do with the patient – you're making it something that's hard, that's difficult…

Asking for help is a topic that Patricia brought up on her own.

I'm not one to unnecessarily impose on other people, but you do have to learn to ask what would happen if I was on dialysis or not. There's always a doctor's appointment or something going on and I could take the Lift Line. I like to take my son with me to the doctor's because I like him to hear; you know, an extra set of ears. I do impose on him to do that. The hairdresser my daughter takes me to most of the time, but I do have a friend that I could call. There are 2 or 3 really good friends that [inaudible]. I've gotten better about [asking for help].

Another instance is when Patricia talked about her interactions with family. She finds it hard to "keep up" with her children's lives in the way that she used to because she lacks the energy. Enjoying the company of her family used to be pleasant, but now there is self-perception of burden, of "an old lady to take care of":

P: My energy level is huge. I used to go everywhere and spend my time with kids, and now a lot of that I don't go to because I think they don't need an old lady to take care of as well. Kids are older now, they have their own lives. That's the toughest thing for me to come back to, they keep going on without me but that's the normal course of events, I guess. I'm thankful for the time I've had, I enjoy whatever time they do spend with me. Some of those things you just can't change. And I think if you don't accept them then you're in worse shape.

A: Yeah...because then you're fighting it?

P: That's right. Constantly…pushing against it. I can't keep up with their lifestyles. I do see the kids, so that's a plus, when they've completely wiped me off the chalkboard – sometimes I think they'd like to…

What struck me was the way she interprets this situation. It is almost a double bind of agency. When her agency is limited ("Some of those things you just can't change"), she has no choice but to accept it or end up "in worse shape." The alternative, the ultimate decision per se, is to not push back but to accept reality including its limitations.

A significant cutback in Patricia's life is family vacation time. Her family vacations in Canada, and Patricia used to go with them and drive an hour each way to a dialysis center in Watertown, New York, an arrangement made by her social worker. With decreased

mobility, it has become harder to make those one hour commutes three times a week. She has recently stopped going all together to make it easier on her family, to lessen the burden of catering to her dialysis needs even when on vacation. She now no longer accompanies the family to Canada:

> *I needed a friend to go with me, and I didn't want to take my kids away from their vacation. To take a whole day out of their time. I took a friend with me and she drove down to Watertown because dialysis isn't covered in Canada. It was an hour drive to Watertown and then back. It wasn't a very pleasant experience.*

Not wanting to take away from the family vacation or worry her children in general is a theme that reoccurred in Patricia's narrative. She is extremely aware of her presence within the family, and what she brings along with a suitcase. Her attitude towards this hard decision to not attend family vacations anymore can be summed up in one simple sentence: "Better to just acclimate yourself than to just fight it."

Phil Arnold, 70 and his wife, Cathy

I was humbled to be invited to Phil and Cathy's home in a close suburb. After one year of treatment, he received a kidney from his sister in 2000 that lasted eleven years until a bout of pneumonia caused it to clot and put him back on hemodialysis. The hardest part of starting treatment over a decade ago was the anticipation of not knowing what to expect. His nephrologist talked about it, and he attended a demonstrative workshop on peritoneal dialysis at the local hospital (which proved the at-home style of treatment was not right for him), but nothing really prepared him for what he was to encounter. Looking back, Cathy says nothing could have prepared them, not just for the treatment but also for its side effects, and she wishes they had been able to visit a center or meet the providers to get a feel for the experience. It would be helpful to have an orientation and some interaction with current dialysis patients. Nonetheless, Phil says "I don't see it as a negative experience."

Lifestyle Changes

While Phil used to balance full-time work and treatment, driving himself and maintaining hobbies, dialysis and comorbid conditions (including diabetes, congestive heart failure, arthritis in the knees, and carpal tunnel in the hands) limit his mobility and have changed that lifestyle. His treatment time now is inconsistent; Cathy drives him as early as 6:30 some mornings. It makes it difficult for these retired schoolteachers to schedule looking after their eight grandchildren after school. His plans for retirement were "interrupted". What was supposed to be the stage in life for spending time with family, part-time work in a golf shop, playing golf with friends, and trips to the Adirondacks is interrupted by frequent exhaustion – Phil describes his post dialysis as a unique kind of weakness and fatigue after which he needs time to recover: "Basically three days a week, he's out," Cathy comments.

Similarly to Patricia's circumstances, travel isn't impossible, but it does require extra planning. The Arnold's have a yearly family trip to Myrtle Beach during spring break for which the social worker has helped Phil schedule treatments in that city. They also spend Labor Day weekend in the Adirondacks. For this trip, Phil gets treatment on two consecutive days to last him the weekend. It's inconvenient and tiring, but Phil seems rather nonchalant: "We're learning to be a little more flexible."

Support Systems

When Phil first started treatment, his three children were all under the age of thirteen. They were stoic; they didn't want to talk about their father's illness, and group counseling "fell flat." Perhaps that influenced the family's decision not to inform their grandchildren about Phil's condition. Their parents haven't discussed it with them, and Phil and Cathy are fine with it being that way. "They think [Phil] is fragile," Cathy admits. Cathy is more likely to sense when he needs help: "He doesn't have to ask for help." Occasionally friends pick him up from treatment and their neighbors mow the lawn. He's always been active and is, understandably, a bit stubborn to accept help, but Phil says "pain makes dependence acceptable."

There used to be more visitors during his treatment time when Phil first started. Now, it's mostly fellow patients with whom Phil socializes; if he's not chatting with techs or watching TV during treatment. Both Cathy and Phil reflect on the relationship patients have with each other. When Phil was on a regular schedule, he would see the same patients and get to know them. Then one day, one might not show up. And the next treatment, still no sign. Vacation? Transplantation? Death? There's no way of knowing which. Privacy regulations prevent techs from reporting on a patient's condition – for better or for worse. Phil recalls a time he asked point blank, if the patient who used to sit in the chair next to him had passed away. "They're very straightforward about death, 'so and so is dead.'" I can feel the mood in the Arnold's living room change. Fortunately for Phil, his wife was always by his side. Married for forty-six years, together for fifty-three. "You went through it with me" he says to her, and I feel privileged to be in the room with them at this moment.

It was also important that he developed a good rapport with the clinicians at the center. Since his transplanted kidney failed, there has been no correspondence with the transplant clinicians who used to be in contact every six months for check ups and monitoring and the NKF chapter[13], what he calls "the kidney people". Now the dialysis technicians, social workers, nurses and other clinicians are the people with whom he is most in touch. Phil has some reservations about Fresenius for creating very long, sometimes fourteen-hour shifts at low pay, causing good workers to leave. They are clearly understaffed. The techs and nurses Phil does see regularly, seem to be reliable and comforting people – "they're nice people, caring…we're a family."

Caregiver Support Systems

When I ask Cathy what resources were at her disposal, as a caregiver not a patient, Phil jumps in instead – a reoccurring event that made me reconsider my decision to interview the couple simultaneously; maybe I would have heard more from Cathy if we were alone. "She's gone to every doctor's appointment, taking notes. I have a tendency to forget things…when I was in [the hospital] for nine weeks, she was there every day and had a diary of everything that went on." Cathy acknowledges she gets some support from family, but having a friend who also has a significant other with a lot of health problems with whom she can relate has been a major help. This friend told her "This is why we're so

healthy – our deal on this earth is to take care of our spouses."

Transplantation

Phil's age and heart condition are two reasons why he is not on the active transplant waiting list. A few family members, neighbors, and friends were potential donors, but all were either non-matches or disqualified for other reasons such as smoking or high blood pressure. That leaves the option of a cadaver donor which Phil averages would take about five years, putting him in his mid-70s. His heart isn't that strong and although Phil's cardiologist technically cleared him for transplantation, both patient and doctor acknowledge the risks of undergoing surgery given the circumstances.

What was more interesting than these two reasons, to me at least, was the Arnold's attitude towards transplantation, an experience they had already undergone just a decade earlier. Having a transplant wasn't ideal, "it wasn't a picnic" in Cathy's own words. When I ask her to expand, Phil offers his own response. Immunosuppressant medications – up to forty-three pills per day at first – made Phil extremely vulnerable to infection and made him insulin-dependent whereas now his diabetes is managed through pills which, including phosphorus-binders and blood thinners, total ten per day. Given the couple's transplant experience, I was curious about their expectations before transplantation. Did they know transplantation would be so stressful? Not so, based on what they had heard from someone who had received a kidney and was a "new person" because of it. "We both were very torn [between dialysis and transplant]," Cathy says. The scheduling and time commitment comes up again, as does constant swelling in Phil's legs and the hassle of frequently changing medications and doses. What's new is Cathy's addition that every time Phil got sick, it was a "life and death feeling" because the kidney was so fragile, so precious. Trips to the emergency room always incited fear of what was wrong with the kidney and the question of whether it would be okay. "It was very stressful…" she says, "Sure it was nice having the freedom from dialysis, but…I don't know." Later on, Phil echoes these sentiments of freedom: "It does free you up. We had talked about traveling around the country, going to Europe, not that we can't now, but it would be difficult."

Samuel Blaise, 41

"B-24," the Kidney Cares volunteer announces. I'm playing Bingo at the organization's annual community picnic in Ontario Beach Park. There's a small crowd, only about 20 people, give or take. "Any luck?" I ask the gentleman next to me at the picnic table. After a friendly conversation I'm introduced to his wife. Both seem to be in their 60s or so, and their son Sam looks around 30. Mr. Blaise does most of the talking, and I'm surprised to learn it is Sam, and not either of his parents, who is currently on dialysis. When we meet up two weeks later for an interview, I'm unsure of how the interview will turn out as Sam arrives solo even though I made sure to invite the family. I am grateful that he was extremely open and comfortable with the subject despite a furrowed brow that made me wonder if my questions were too personal. He insisted they weren't and told me more than I had even thought to ask, only pausing to stutter or to gather his thoughts.

Sam works full-time in the purchasing department of a local non-profit service center. "Luckily I have a flexible job. Sometimes I don't feel that great, and they let me work later [on another day]." Three out of the five days of the working week, after work, Sam drives himself to his second shift: dialysis. The evening shift tends to house younger patients to accommodate work or other commitments. In a very matter-of-fact tone, Sam says he gets hooked up quickly, is on for three hours, takes fifteen minutes to disconnect and wait for his fistula to clot, and then grabs something to eat on the way home, a short commute. Normally, he doesn't feel that bad after treatment. About once a month, he gets worn out. "It's like you've partied too much" he says. "Without the party?" I joke. "Exactly!"

There are three groups of medical professionals, Sam tells me, particularly among the nurses, rather than the nurse practitioners or doctors. The first group is good at what they do and cares about the patients. The second group is good at what they do, but it's just a job to them. And the third group is not very good and doesn't really care about the patients. "In all of my fifteen years of dialysis, you meet all three groups of people…If you don't like the people…the three hours can be a lot longer." His interactions with social workers are minimal, "only when I need to sign something."

Support Systems

Sam lives alone, his parents thirty to forty minutes away in the outskirts of the greater Rochester area, but he feels very independent. When I asked whom he would call if he ever did need help, he said his parents are an option but "most of the time, I just wait until I feel better." Emotionally he seems pretty self-sufficient as well. Sam's main concern regarding his family is that they worry. They don't have to drive Sam to treatments, but they do check up on him over the phone. "It's more from an emotional standpoint than a physical one."

He attended the kidney support group when the Rochester NKF chapter existed in Rochester and would consider attending another group if they started up under the newly formed replacement, Kidney Cares. A lady, whose husband had been on dialysis and later received a transplant, ran the group he used to attend. Everyone's story was different – some had transplants, some were on peritoneal dialysis, etc. Each session lasted about two hours, and most times there was no agenda. Unless there was a guest speaker, like a social worker, any topic was fair game for discussion. When the group was dissolved, there were only a few people left in it.

Sam was in the unique position of being a caregiver to his sister who also experienced kidney issues starting in 1993. Even after her transplant, complications with her native kidneys caused seizures and she was in the hospital frequently. Sam and his sister even overlapped at one point in the timing of their treatment.

S: We did more things together because of it, but we didn't talk about it. It was almost an unwritten thing. We didn't want to show each other..if… we were having the same problems, but we uh did more things together. Like she worked as a cashier and customer service rep in [department store] and I would pick her up during her lunch break and we would like go to the movies together. I think um…if we did [talk about it] it was more in a general sense, not as much how we were feeling.

A: Do you think your relationship would have been different with her had you not been going through the same circumstances?

S: I mean I guess we were close as brother and sister but I think I – I – I it brought us closer, since we did.

Sam's sister passed away in 2004, at the age of 23. The autopsy revealed that her medication dosages were off. Every time doctors tried to lower her dosages, she would start to reject the organ and thus they had to keep them very high. These dosage changes took a heavy toll on her body. One of the side effects that went under the radar was clogged arteries leading to a heart attack.

The more we talked, the more I learned about Sam's family. His mother had undergone six months of chemotherapy for ovarian cancer just prior to his sister's diagnosis. I asked Sam to compare chemotherapy and dialysis, in terms of the demand placed on families:

I guess it's in a way they're alike. That you know um you know… either being on hemodialysis or chemotherapy, I'm sure you feel worse on chemotherapy but um you know there's some similarities. I guess in one way it's...it's one way harder because usually during chemotherapy you're feeling a lot worse…there's worry about dying. With dialysis as long as you don't have other issues, you know you can um, usually you don't have to worry as much about dying. Chemotherapy, you can get off of it sooner. Hopefully, and then you'll be okay. Dialysis is more of,uh, well, transplant but it's… it's [A: more long term?] yeah, long term. It doesn't seem as serious but um, anyway.

Transplantation

Sam was diagnosed with kidney failure due to a rare disease called Focal Segmental Glomerulosclerosis in 1994 and had four years to "prepare" for the transition to dialysis which he started in 1998. Perhaps because he was young (in his 20s at the time), or perhaps due to some twist of fate, he received a kidney that same year only for it to fail less than two weeks later, before he even had the chance to leave the hospital. First a vein broke, which put him back into surgery, followed by an infection that led to him having to get the kidney removed in another surgery. He worries that going back to the OR for another transplant would lead him down the same path as his sister. Another complication arises when Sam goes into surgery and his potassium spikes, a risk worth consideration after the surgeries he's already had. Lastly, he confides a third hesitation is the pressure, the responsibility, and perhaps the burden, that would result for his parents.

S: I hate to – especially for my parents – go get the transplant and then something goes bad…If I knew, I was married and had family members or something…they're [Sam's parents] much older than I, I hate to have them, because they've already been through it many times [with Sam's sister], I would hate to have them go through. Because with the transplant, there's ups and downs, and also you know for at least the first few months, I would lose my independence. You can't drive for a while and you've got all these appointments so yeah, there's a part of me that really wants to do it…

Sam has been on the transplant waiting list since November of 1997 since, technically, his first operation was unsuccessful. There's only one caveat: he requested to only get a call if they find a perfect match, a situation that Sam admits "that's virtually never going to happen." He can call and request to be on the active list and take any kidney that is a reasonable match if he wanted to, but he is waiting until he can't take dialysis anymore. He's seen first-hand what his parents went through with his sister, saying "I worry now because now they're older" recalling an incident two years ago in which his father fell and broke his collarbone. Sam does not want them "to go through that all over again" now that there's higher chances they would get sick. "Besides them worrying about me, is not you know if I get a transplant…for them, all the way in [town, thirty to forty minutes away]. If I knew more people, I might be more inclined to do that. At least at first, I wouldn't be as independent with the transplant."

Roseanne Carter, 40s

Roseanne is a self-proclaimed patient advocate. With a nursing degree and a wealth of dialysis experience under her belt, she's a real veteran to the field. She graciously accepted my invitation to meet at a local library for an interview. Her story starts differently than the others – with a rare genetic condition called medullary cystic kidney disease that caused her kidneys to fail at the age of eight. Hemodialysis then was a "primitive process" without the more compact machines available today. Furthermore, immunosuppressant medications were not as developed, so she was put on very high doses of the steroid prednisone, a very damaging drug when used long term. She received a transplant from a cadaver donor at age ten ("kids don't thrive on dialysis") which lasted eighteen years. She received her second transplant in 1995, which lasted another six years.

Now back on dialysis, Roseanne spends her treatment time managing her E-bay business, playing phone games, or people watching. She's afraid to fall asleep for fear of another near-death experience – the last time she dozed off and didn't keep a careful eye out, the dialyzer wasn't tightened enough and a liter of blood was on the floor when she awoke. She had to be rushed to the hospital for a blood transfusion. Roseanne is a bit cautious at first: "I'm not putting them [the dialysis clinicians] down, but things happen." I reassure her and she elaborates on her other concerns. She's allergic to the standard fluid used to clean the lines[14] - like any allergic reaction, it causes itchiness but it's even more painful because it's her blood that's itchy. She requires a special bio-allergenic dialyzer fluid, the lines must be rinsed with two bags of saline instead of the normal one, and she requires Benadryl to counter any potential reactions.

"I feel I live a pretty normal, active life despite dialysis." Like the other patients I have talked to, Roseanne acknowledges the exhaustion that often follows treatment and said that she and her boyfriend "don't plan much" on dialysis days because how she feels after is unpredictable, it is a draining two and a half hours. "Anxiety is my biggest problem," she says. Her past experiences (as described above) aren't much reassurance for the future. She is on the fence about a third transplant and is not currently on the active waiting list.

I could possibly have a third transplant. But the more antibodies you build up toward you know reject another one plus if you have a blood transfusion that messes with your antibodies. Plus I've had two and you know suppression, I've already had so much prednisone so I'm worried about that…Most people say transplant is a cure-all, but it's not. It's trading one set of problems for another set of problems.

Support Systems

Roseanne lived alone for a while and currently lives with her boyfriend. When she had a transplant, she was working two jobs – "I'm not used to depending on people." Now that she is not working full-time and also gave up her car, which depressed her for months, she is learning to depend more on others. Loss of independence is a "downfall of the whole chronic illness."

Roseanne said she didn't date much. "It really takes a special person to deal with the chronic illness with you and if you're not together for a long time, it doesn't work!" she says with a chuckle. Her current boyfriend has a few illnesses to contend with, "I guess we take care of each other, and I like that." Roseanne hesitates when I ask if she considers her boyfriend to be a caregiver. "When I was sick yes, but I'm not sick now." The relationship is a very positive thing for Roseanne – with a house, and a garden, and her boyfriend "life is infinitely better." He understands her needs and treats her well – I hear about her birthday celebration that he arranged just last week.

I don't like being a burden on people…I told him [before we met] I was independent, working, and now I'm so – and he stopped me and said 'don't think, you're not so' – he doesn't think about me that way.

Aside from intimate relationships, Roseanne has made use of community services and programming offered by the NKF when it existed, "I was so upset when NKF left." She played bowling and table tennis in the "Transplant Games" (a national Olympics of sorts for transplant recipients, donors, and their families), received financial help a few times, including a scholarship to get her pharmacy technician certification, and discovered her passion for patient advocacy – it was a branch of NKF of sorts. She hasn't been involved with Kidney Cares – "it's kind of fizzled out, the Kidney Foundation was very…active" and Roseanne knew the executive director and a few others from the foundation.

Patient Advocacy

Her allergies and past experiences strengthen her resolve to be her own advocate, even though she was once told by a clinician: "oh, if you're not nice or whatever, if you tell on me…I won't give you a Benadryl." Given the circumstances, she still "people watches" during her treatment, observing the new clinicians to make sure they're abiding by the protocols. There's a high employee turnover at the clinic and Roseanne feels the need to look out for her and other patients' "own well-being." Given serious oversights that have occurred in the past, it's no wonder Roseanne feels so much anxiety about treatment. "I just watch… and then I pick what I want to take care of."

After her second transplant failed, and a brief exposure to peritoneal dialysis resulted in complications, Roseanne returned to hemodialysis. "To see the machine again and have all those needles, I was petrified." There was really no one, besides a nurse practitioner, that helped her transition. Social workers, she says, are overburdened with paperwork and it detracts from their ability to interact with patients on an emotional level: "It's a financial job, now." The programming that's done now is often incongruent with patient needs. Roseanne recalls a raffle for patients for a turkey when half of the patients live in nursing homes and have no use for a turkey. Or the time they gave out a third-grade activity (coloring, puzzles, etc.) book to occupy their time. "One thing that's lacking is a social worker / counselor to go around and ask how this affects you." Roseanne feels that her age-group, middle-aged fairly healthy patients are left out because most patients are elderly and fragile. "We're the ones who need counseling."

Though dialysis has come a long way from the "primitive process" Roseanne experienced in the 1970s, she is quick to point out the limitations of technology. The machines, for example may spout some scientific reading, but that does not equate to how a patient feels. Roseanne has been questioned, "how can you possibly feel this when the machine reads that?" She doesn't sound bitter when she tells the story, just reflective, even hopeful with suggestions on how to improve clinician understanding: "It takes a special kind of person…I think when people are hired for dialysis clinics, there should be a patient – maybe an orientation that says 'this is what you need to know as an employee,' but from a patient's point of view." Additionally, according to Roseanne, the new computer systems don't have the capacity for individualization.

Besides making mistakes, clinicians sometimes patronize patients. Roseanne likes to be, and is certainly capable, of being involved in her care. She makes an effort to research and learn about her treatment. For example, when a new machine called the "Crit-Line," a device that monitors absolute hematocrit and oxygen saturation in the blood, was introduced, Roseanne did her own research online to understand it. However, she was told "you wouldn't be able to understand everything we got educated on" by a nurse. "One of the big things is being treated like second-class citizens, like you're beneath [them]…Don't treat me like an invalid…probably ninety-percent of patients feel demeaned."

Overall, Roseanne has some great ideas to improve the dialysis experience. Like Phil, Roseanne is troubled by the privacy restraints that prevent patients from knowing when their fellow patients pass away. Roseanne would like to see a memory board of sorts to commemorate the deceased instead of just watching them pass way without notice. "At dialysis, you see one little aspect of their entire life," she says, reflecting on a patient who had passed away. Upon reading her obituary, Roseanne learned she was a retired professor, among other details. Another idea is to start a blog, maybe focusing on dialysis-friendly recipes to help patients manage their diet. And of course, that new employee orientation – from a patient's point of view – to break down that wall between patients and employees.

They think patients will rise up, we just want what's right for us…They go home regardless of what they do. If something goes wrong with my treatment, I have to deal with it for the rest of the day, potentially until the next treatment.

Stemming off of her role as a patient advocate under NKF, Roseanne has continued her advocacy. The previous social workers helped by connecting Roseanne with new patients that were looking for advice and someone to talk to. Advice ranges from 'bring a blanket, it gets cold' to more serious topics like making sure someone knows your medical history in case you are found unconscious. Lately, the referrals have slowed down. "I just want to help people get through this; it's not fun. It's something you cope with, but it's not fun.…If I can make it, you know, easier…If I can do anything that will help."

Discussion

Looking back, I am surprised at the wealth of knowledge I have learned by simply listening, and I am extremely grateful for the way my informants opened up to me and received my curiosity with such kindness. A few themes present themselves: perceptions of kidney transplantation, the comparison of dialysis to a "second shift" or job, a negotiation of normalcy, and the need for patient services.

In most cases, dialysis is a temporary treatment, the ultimate goal being kidney transplantation from a living or cadaver donor. Transplantation comes with its own set of complications like infections from the surgery itself, organ rejection, and a lifetime of being immune suppressed, among others. Nonetheless, transplantation is considered the best renal replacement theory – patients are shown to live longer and from an economic point of view, it is less costly than persistent dialysis[15]. Despite these benefits, and of no surprise to my informants, transplantation is not a panacea for kidney disease or even lifestyle complications due to dialysis.

My initial thought that life on dialysis is without a doubt a more burdensome lifestyle than kidney transplantation was not correct. My informants, particularly those who have had unsuccessful transplants in the past, find dialysis to be a lifestyle that is less burdensome because the risk of surgery, as well as the post-surgery complications that arise from immunosuppression, would be a bigger burden on their families and result in a less desirable lifestyle. Phil mentioned the upside of transplantation as granting mobility, less exhaustion, and a smaller time commitment, but it would come at the cost of managing his diabetes via pills rather than insulin (his first transplant made him insulin-dependent), fewer medications overall, and less fear of protecting such a fragile organ. Torn between the two, Phil calls this state being "in limbo." Sam also worries that a transplant would result in a loss of independence during the quarter-year recovery process. Roseanne captured the dilemma well when she said, "Most people say transplant is a cure-all, but it's not. It's trading one set of problems for another set of problems."

A second theme from the interviews was the comparison of dialysis to a second job. Most treatments are three times a week and last three to four hours during which the patient cannot get up from the dialysis chair. Missing a treatment is risky – the dialysis machine acts as an artificial kidney, filtering fluids that would otherwise accumulate in the body. Unfortunately it is a second job that doesn't fall within the hours of 9 to 5. Even on non-treatment days, patients must watch their diets (limiting nutrient intake like potassium) and restrict fluids. Consuming more fluids requires a stronger treatment and may cause heart damage. Three of my four informants had experience working full-time while receiving dialysis and had to schedule shifts – the term used even in the clinical setting – in the evenings like Sam or experiment with at-home peritoneal dialysis like Roseanne.

There also seems to be a hierarchy one could compare to that of a workplace. When I started my research, I approached the clinic's medical director. Questions about more-detailed patient needs resulted in a referral to a nurse practitioner who was thought to spend more time with patients than directors. This provided me with some insight, but again, ended with a recommendation to talk to a social worker whose purpose is to attend to social needs. While I received a wealth of information from the social worker, patients didn't seem eager to recommend them as knowledgeable. As Roseanne alluded to, social workers don't have the time to interact with patients because of responsibilities like sorting out insurance and transportation. Both Phil and Patricia worked with a social worker to arrange dialysis treatments while on vacation, but other than that, they had limited interactions. Furthermore, there is a "wall" between patients and clinicians in which the former are often expected to show up, be courteous, and be silent about concerns: "oh, if you're not nice or whatever, if you tell on me…I won't give you a Benadryl." It seems that patients' social needs are at the bottom of this hierarchy. Even lower on the totem pole? Patients themselves.

Normalcy complements the theme of burden. For Roseanne ("I feel I live a pretty normal, active life despite dialysis"), normalcy is something that she was able to maintain even with dialysis treatments. Being active and independent, both physically and socially, was an important part of achieving normalcy. On the other hand, Patricia's sense of normalcy was compounded by changing family relationships, including the aging of her children into adults with their own lives and families, and her worry of posing a burden on them: "That's the toughest thing for me to come back to, [my children] keep going on without me but that's the normal course of events, I guess." Compounded further by other health issues and aging in general, it seems as though Patricia has come to accept a "new"normal, which inevitably includes personal sacrifices (ie: independence and mobility) as well as social sacrifices (ie: not vacationing with the family). In just these two narratives, there is a diversity of experiences. Yet, as mentioned earlier, NKF guidelines claim that normalcy is possible and should be expected for dialysis patients: "Many patients live normal lives except for the time needed for treatments." Individual narratives show that normalcy is disrupted by more than just time needed for treatments, including social relationships and constraints on agency, to name a couple. What does it mean for a national, institutional narrative to portray the dialysis experience as relatively undisruptive? Is there space in this dominant narrative for a diversity of individual experiences in achieving normalcy? A larger sample size would be needed to unpack these ideas.

Lastly, the data indicates a tremendous need for patient services on a more personal level. The centers seem understaffed given that each patient has unique needs. Social workers seem overwhelmed with the number of patients, and with their responsibilities of coordinating the insurance payments and logistics of getting to and from dialysis. There is little time left for patient interaction, for acknowledging and responding to more intangible patient needs and rights. Some of these are as simple as the right to know about their treatment and why certain decisions have been made and others are more complex such as managing changing relationships with family and feeling like a burden (see: Patricia). A holistic approach to caring for patients is absolutely necessary because, in Roseanne's words, "At dialysis you see one little aspect of their entire life."

I began this study curious to unpack the term "burden" in the ever-popular phrase "burden of care" or "caregiver burden." I now realize that it is indefinable. Relying on a pre-defined notion of "burden" is limiting. Burden includes physical

limitations like fatigue or infection as well as lifestyle changes, but it also surpasses these. Whether they used the word "burden" or not, I found that each informant alluded to some unavoidable imposition on family or friends – it is Phil's ideology that "pain makes dependence acceptable," it's Patricia's decision to opt out of the family vacation, it's Sam's awareness of his parents' worry and involvement if he pursued a transplant, it's Cathy finding comfort in a friend whose spouse also has a chronic illness, it's Roseanne telling me that her boyfriend was her caregiver "When I was sick, yes, but I'm not sick now" (emphasis added).

When I was talking with Patricia about how friends and family try to understand her situation, I told her, "I guess you can't always put yourself in someone's shoes" and she caught me by surprise when she said, "They're not always shoes that you would want yourself to be put in." While this may be true, it seems vital for dialysis patients to interact with someone who knows what the dialysis process is like from experience. Even caregivers, regardless of compassionate intentions, may never grasp the reality their loved ones face. Patient advocacy, as Roseanne stressed, is key. Moving forward, as we expand our services, pursue more interactions, and strive to ease "the burden" on dialysis patients and their caregivers, we must ask how can we help if we don't fully understand. Understanding is the key to empathy and developing compassionate care.

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4. All names have been changed for privacy purposes
5. Located in a suburb of Rochester, NY
6. http://www.kidney.org/atoz/content/dialysisinfo.cfm
7. All names have been changed for privacy purposes.
8. A note on methodology:
The majority of outpatient dialysis clinics in Rochester, NY are serviced by Fresenius Medical Care, an international dialysis service provider, even those under a community hospital or university. Though study recruitment did not take place at a Fresenius clinic, I was advised by the clinic director to pursue a corporate Fresenius Research agreement. This process was long and tedious as the contract was geared toward clinical research and pharmaceutical trials and required signatures ranging from the local clinic director up to the Fresenius Vice President of Clinical Research. The corporate study coordinator did not seem to understand the qualitative and exploratory nature of this HIPPA-exempt study and did not modify the contract to exclude the non-applicable clauses. After two months of negotiation, I decided not to pursue the contract. Upon hearing the news, the coordinator I had been working with offered to waive the one hundred dollar application fee. If not for the money, I am curious as to why Fresenius was so insistent on the contract – which included such clauses, as "Investigator will provide FMCNA [Fresenius] with the manuscript two (2) months prior to submission." After all, my study was not an evaluation or assessment of dialysis service or providers.
9. http://www.kidney.org/atoz/content/dialysisinfo.cfm
10. Plastic wrap is used to keep the cream in place as it could numb other parts of the arm. It must be applied about an hour before dialysis. For Patricia living alone, it was a difficult task to apply the cream and wrap her upper arm with only one hand.
11. It should be noted that a significant lifestyle change is diet, with particular emphasis on limiting potassium, phosphorus, and fluid intake. I chose not to focus on diet because Patricia did not emphasize it in our interactions.
12. Odd days refer to non-dialysis days.
13. The Rochester NKF chapter closed in 2011 due to a lack of revenue. A new 501(c)3 non-profit, Kidney Cares has formed to fill the needs left behind, but is still in its beginning phases of development.
14. Lines are the pipes through which blood flows out of the body, through the machine, and back into the body.
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The Influence of ECFA on Taiwan's Public Opinion of Cross-Strait Relations

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Economic ties are a crucial aspect of the cross-strait relations between China and Taiwan.[1] Since the 1990s, the gradual growth of cross-strait trading and the increasing investment of Taiwanese businessmen in China have been integrated into official political efforts to ease the tensions across the Taiwan Strait.[2] Years of economic interactions have not only led to increased mutual understanding, but also created economic interdependence on both sides.

Aware of the influence that its growing economy could exert on the other side of the strait, China has sought to institutionalize economic contacts across the strait to sway Taiwan in the choice between unification and independence. The Economic Cooperation Framework Agreement (ECFA), signed in June 2010, is a perfect representation of efforts made to broaden cross-strait economic channels.[3]

The impacts of ECFA on the Taiwanese public received less attention than its influence on Taiwanese policy makers. Existing studies saw ECFA as an important point to be exploited by political players in Taiwan before the 2012 presidential and legislative elections.[4 5 6] At the same time, it should be noted that in a democratic political system, policy makers are not isolated from public opinion since their decision-making process has to take into consideration the reaction of the voters. However, it remains unclear how this channel of economic influence interacts with Taiwanese public opinion about independence versus unification. I hypothesize that people in Taiwan would be more supportive of unification if they perceived changes in economic conditions as a result of ECFA bettering a more positive manner, and that this effect would be more significant among the advocates of parties that strive for the independence of Taiwan.

Based on the *Survey of the Presidential and Legislative Elections 2012* from *Taiwan's Election and Democratization Studies*, my study examines how different groups react to the influences of ECFA on their preference for independence versus unification in two linear regression models and two probit regression models. It incorporates a set of questions about respondents' opinions between endorsing an independent Taiwan and supporting unification with China and their opinions about the Economic Cooperation Framework Agreement. My study also takes advantage of the survey data about other relevant variables, such as party affiliation, ethnicity and age. In general, the results support my hypotheses that Taiwanese people who perceived better economic conditions as a result of ECFA are more supportive of unification with China, and that this impact is conditional on their party identification. My study also has implications for future studies of cross-strait relations and methods of measuring public opinions about the cross-strait relations.

Historical Background and Theories

In order to better understand the roles ECFA plays in Taiwanese politics and cross-strait relations, it is best to be familiar with recent changes on both sides of the Taiwan Strait.

Southeast to the Asian mainland, the Taiwan Strait has been the theatre for the dramatic separation between mainland China and Taiwan since the end of the Chinese Civil War in 1949. After decades of confrontation in the shadow of the Cold War, a new chapter of the cross-strait relations came in the 1980s and 1990s. In 1987, Taiwanese leaders lifted martial law to open the door to democracy, and after its first presidential election in 1996, Taiwan officially became a democracy.[7 8] Meanwhile, the Chinese Communist Party adopted a new policy of reform and opening-up in the early 1980s, and the Chinese economy started to boom.

Democratization in Taiwan

The democratization of Taiwan has had significant effects on Taiwan's mainland policies. Using the data from Virtual Research Associates, Kuan Hung-Chang found that democratic elections on the Taiwan Island have had significant effects on the aggressiveness of Taiwan's mainland policies, namely that Taiwan's cross-strait policy have become less cooperative as it comes closer to the presidential election in Taiwan.[9]

Moreover, democratic elections in Taiwan allowed partisanship and some demographic factors to influence Taiwan's policy towards China. Since the Democratic Progressive Party came into being as an opposition force in the era of the Kuomintang's authoritarian rule, Lay, Yap and Chen argued, the Democratic Progressive Party "was founded along a distinct ethnic and political line, aiming to challenge the Kuomintang's doctrines and

promote self-determination for Taiwan".[10] The opposition party upheld Taiwanese identity and pushed for Taiwan's independence to mobilize the ethnic groups that did not emigrate the mainland after the Chinese Civil War.[11]

China's Economic Development

At the same time, the transformation on the other side of the strait was due more to economic reform than changes in political institutions. Prior to the policy of "Reform and Opening-up," China's economy was far less developed than Taiwan's. The gap between the two economies was a result of errors in China's economic policies prior to and during the Cultural Revolution, as well as policies made by the Kuomintang leaders to transform the economy in Taiwan into an industrialized and trade-dependent one.[12]

Soon after the Chinese leaders started to reform the economy, an astonishing economic growth rate began and has been sustained for years and has created an imbalance of power between China and Taiwan. According to the Statistical Communique of the People's Republic of China on the 2012 National Economic and Social Development, China's average annual GDP growth was 9.91% from 1979 to 2010. Wu Yushan argued that China's economic development in the past three decades broke the previously maintained economic balance between Taiwan and China.[13] The imbalance of power between the two countries is even more salient now that the quality of the Chinese economy has caught up. China is many times the size of Taiwan in many aspects, including GDP, the growth rate of the economy and the foreign reserve.

Economic Ties Across the Strait and ECFA

As a result of the policy changes in Taiwan and China, unprecedented economic interactions became possible and gradually increased. Since the early 1980s, several waves of fortune seekers from Taiwan headed for China to invest in various construction projects and start their own businesses, resulting in the interconnectedness between these two economies.[14]

Although Keng Shu and Gunter Schubert argued that "China's attempts to use Taiwanese business people as a means to gain political leverage over Taiwan will not pan out as a successful strategy," it is not an exaggeration to state that more Taiwanese people have benefited from the peaceful cross-strait relations and have had higher stakes in economic ties.[15] Choi argued that the effects of economic evaluation mattered in Taiwanese voters' decision-making process. Given the growing importance of cross-strait economic contacts, Taiwanese people's economic evaluations naturally include the benefits brought from the other side of the strait.[16]

In addition to the communication and interactions among the people, negotiations at the governmental level also started through proxies to institutionalize cross-strait economic contacts. Since the early 1990s, mutual efforts were made to incrementally dismantle the restrictions on trade and economic ties through agreements. ECFA, the most recent among many such agreements, has garnered more attention than previous agreements. On the one hand, ECFA was believed to reflect China's Taiwan policy—taking economic matters as political, so as to "increase exchanges that are conducive to cultural and national identity across the strait." On the other hand, ECFA created a huge division in Taiwanese politics along party lines. The Kuomintang side endorsed this preferential trade agreement for the economic benefits in a larger Asia-Pacific context, while the Democratic Progressive Party claimed that this agreement would hurt the economic benefits of white-collar workers and the interests of many traditional industries, demonstrating that in Taiwan, ECFA is embedded in party politics.[17]

Most academic discussions have focused on the implications ECFA has had on the economic interdependence between Taiwan and China and on the 2012 Taiwan presidential and legislative elections.[18] For instance, Rosen and Wang argued that ECFA points to the significant benefits of cross-strait economic reform and further Asian economic integration. Given the absence of a domestic consensus about this agreement on the island, ECFA could create "repercussions within Taiwan and between the two sides of the strait" through the 2012 elections.[19]

It remains to be examined how ECFA would influence public opinion about the cross-strait relations. Now that the economic evaluation of ECFA is also deeply intertwined with the politics on the island, I hypothesize that:

H1: In general, the greater the economic benefits the Taiwanese people perceive ECFA to create, the more likely they are to support unification with China.

H2: This influence is conditioned on the party identification of the people; namely, the perceived economic benefits of ECFA would lead to more support for unification with China among the supporters for the pan-green camp led by the Democratic Progressive Party than among the advocates for the Kuomintang-led pan-blue camp.

Research Design

In order to test these hypotheses about the influence of ECFA on Taiwanese public opinion of the cross-strait relations, I use two linear regression models and two probit regression models, and employ the TEDS2012 dataset in the *Survey of the Presidential and Legislative Elections 2012*. Conducted after the Taiwan presidential and legislative elections, this survey provides comprehensive information about the respondents' opinions about Taiwan's independence from China, Taiwan's unification with China and ECFA.

To measure public opinion in Taiwan about cross-strait relations, I took several questions in the survey asking about people's opinions about Taiwan's independence from China or unification with China. First, TEDS2012 asked respondents to show their positions on an 11-point scale, with 0 representing independence and 10 representing unification. The distribution of answers is shown in Figure 1. Among the 1626 people who gave valid answers, more than half of the respondents preferred the status quo. At the same time, more than a quarter were on the independence side, leading the unification side with a 10% margin. This margin is mainly contributed by extreme advocates of Taiwan's independence, indicated by the far left bar. Excluding this bar, on each side of the spectrum, the responses are evenly spread. The values of the valid answers are directly transformed into the first dependent variable as a measure of opinions about Taiwan's independence and unification with China.

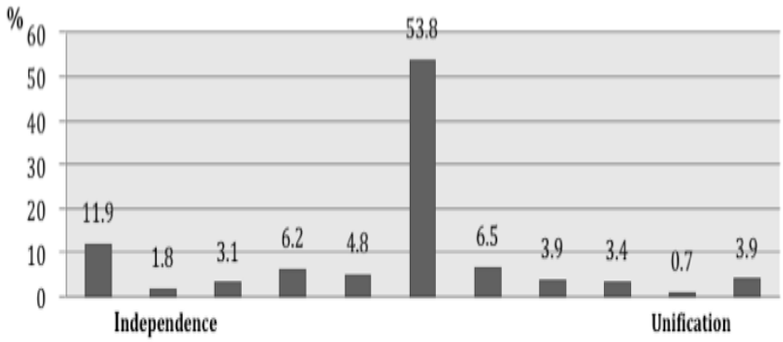

Figure 1. Taiwanese Public Opinion About Independence And Unification

Source: Taiwan Presidential and Legislative Elections Survey 2012, from Taiwan Election and Democratization Studies

Note: 1626 valid answers. "Refuse to answer," "it's hard to say" and "don't know" are dropped. See Question 1 in the Appendix.

The second measure comes from two questions in the survey, which ask if respondents agree that Taiwan should unify with China if there is a gap of economic, political and ideological conditions between the two sides of the strait and if those conditions are the same. Table 1 presents the distribution of answers to those two questions. Only the answers in which the respondents clearly expressed their preference are retained. In addition, the extreme answers—"strongly disagree" and "strongly agree" — are merged into "disagree" and "agree" respectively.

Table 1 Unify With China Under Different Conditions

		Unify when conditions are different	
		Agree	Disagree
Unify when conditions are the same	Agree	9.8%	30.3%
	Disagree	1.8%	58.1%

Source: Taiwan Presidential and Legislative Elections Survey 2012, from Taiwan Election and Democratization Studies

Note: 1517 valid answers. "Refuse to answer," "it depends," "no opinion" and "don't know" are dropped. See Question 2 and 3 in the Appendix.

Table 1 reports that the respondents' preferences for unification with China could be influenced by the relative social economic and political conditions. Only about 11.6% of the respondents agree to unify with China when a gap of these conditions between Taiwan and China exists, but this number more than triples when this gap is eliminated. Even more notably, nearly a third of the respondents changed their positions to support unification when the gap of socio-economic conditions is erased, indicating that public opinion of cross-strait relations is partly susceptible to the changing conditions on both sides.

For fear that the phrasing in one of the two questions might lead to two possible interpretations of the word "gap," which is shown to be the case by Table 1, I use the other question, which asked about opinions regarding unification when conditions across the strait are the same. to examine the influence of ECFA After invalid answers are dropped from the sample, the remaining 1575 answers are coded as 1 if "agree" or "strongly agree," 0 if otherwise, making a dummy variable for my analysis.

In addition to these two dependent variables, the *Survey of the Presidential and Legislative Elections 2012* also includes questions about the key independent variables that my hypotheses relate to—the influence of ECFA and party identification of individual Taiwanese. Two questions in this survey enable me to examine the influence of ECFA on the public opinion of cross-strait relations. In these two questions, respondents were asked if Taiwan's economy and their own economic situation had gotten better, worse or stayed the same since ECFA was signed in June 2010. Based on these two questions, I introduce two variables measuring the influence of ECFA on the economic conditions in Taiwan, by assigning the values of 3, 2, and 1 to the perceived better, same, or worse economic conditions as a result of ECFA.

Party identification is introduced to my study as two dummy variables. It is important to note that, instead of the two major parties in Taiwan—the Kuomintang and the Democratic Progressive Party—the focus of my analysis is the major political camps. Although only 9 (8%) of the 113 seats in the Legislative Yuan are not controlled by either of the two parties, it is possible that strategic voting in Taiwan could exaggerate the share of these two parties. Other than the shares in the Legislative Yuan, the high level of policy coherence in different party camps also directs my coding decision. Similar interests in Taiwanese national identity are shared "by the Democratic Progressive Party and the Taiwan Solidarity Union, which comprise the 'green camp'".[20] The pan-green camp was formed in opposition to the "blue camp," consisting of "the Kuomintang and the People's First Party, plus the tiny New Party, all of which continue to adhere to the 'one-China principle'". These two political camps continue to represent the different positions Taiwan might take on the issue of cross-strait relations. For these reasons, I reclassify party identification into camp identifications, making two dummy variables to represent respondents' affiliation with each of the

two political camps. In each variable, a value of 1 indicates that respondents identified themselves with this party, and a value of 0 indicates otherwise. Two other parties, Green Party Taiwan and Communist Party, are included in the survey, but due to the nominal effects these parties have on Taiwan politics and the unclear positions they take on cross-strait relations, they are not coded as any of the two political camps.

Since my second hypothesis has to do with the interaction between the influence of ECFA and party identification, I add four interaction variables into the analysis. They are constructed on the two ECFA variables and the two party identification variables described above. No further modifications have been made to party identification variables and the ECFA variables when the interactions between the two are examined.

In addition, I introduce four control variables. First, I include a variable measuring respondents' education levels to account for what Choi identified as the modifying effect of education on one's economic experience.[21] Second, I use respondents' ages to control for the differences of opinions in different generations because of the research conducted by G. Andy Chang and T.Y. Wang, which employed the concept of political generation and found that self-proclaimed identity across different generations is moving towards Taiwanese.[22] Third, according to the options in the income question in the questionnaire, I show respondents' income levels on a 1-10 scale, with 10 representing the highest level of income. Fourth, I include a measure of the influence of ethnicity from the respondents' parents.

Empirical Results

My analysis is in four statistical models; the results appear in Table 2. Among the control variables, the age of respondents remains significant in all four models. The older the respondents, the more likely they are to support unification. The respondents' income is only statistically significant in the first two models, but it is less significant in comparison with the generational effects. Education and ethnicity variables have not shown any statistically significant results.

The non-significant impact of ethnicity might reflect the possibility that ties of blood would appear less significant in the growth of the nation-state or be overshadowed by other social factors, such as political polarization.[23] It is also possible that most young people of mainland descent in Taiwan are less emotionally supportive than their parents or grandparents, as shown in the 2005 study by G. Andy Chang and T.Y. Wang on generational differences in Taiwan politics.

Independence or Unification

	Favouring Independence or Unification		Favouring Unification with China if conditions are same	
	Model #1	Model #2 (With Interaction Terms)	Model #3	Model #4 (With Interaction Terms)
Intercept	3.541*** (2×10^{-16})	3.687*** (2×10^{-16})	-0.894*** (8.5×10^{-7})	-0.799*** (0.0009)
ECFA				
Influence on Taiwan's economy	0.388*** (0.0002)	0.554** (0.0089)	0.188** (0.0051)	0.192 (0.1482)
Influence on personal economic situation	0.116 (0.4580)	-0.307 (0.3417)	-0.076 (0.4424)	-0.207 (0.3074)
Party Affiliation				
Blue Camp	0.501** (0.0020)	0.891. (0.0572)	0.351*** (0.0005)	0.220 (0.4485)
Green Camp	-1.205*** (4.91×10^{-15})	-1.906*** (2.35×10^{-6})	-0.136 (0.2027)	-0.278 (0.2806)
Interaction				
Blue × ECFA Economy		-0.331 (0.2169)		0.050 (0.7653)
Green × ECFA Economy		-0.159 (0.5597)		0.070 (0.6970)
Blue × ECFA Personal Economic Situation		-0.145 (0.7150)		0.218 (0.3808)
Green × ECFA Personal Economic Situation		1.045* (0.0131)		0.085 (0.7551)
Education	0.007 (0.8343)	-0.005 (0.8718)	-0.010 (0.6635)	-0.008 (0.7150)
Age	0.100* (0.0238)	0.114* (0.0107)	0.097*** (0.0005)	0.101*** (0.0004)
Income	0.052* (0.0107)	0.052* (0.0110)	-0.001 (0.9406)	0.000 (0.9999)
Ethnicity	0.050 (0.6613)	0.079 (0.4875)	0.055 (0.4374)	0.053 (0.4554)
N	1208	1208	1259	1259

.p< 0.1 *p< 0.05 **p< 0.01 ***p< 0.001

Standard errors are in the parentheses.

Source: Taiwan Presidential and Legislative Elections Survey 2012, from Taiwan Election and Democratization Studies

Note:

Model #1 and Model #2 use Linear Regression Model, where the dependent variable is a 11-point scale measuring the respondents' opinions about independence and unification, represented by 0 and 10 respectively. Model #3 and Model #4 use Probit Regression Model, based on a dummy variable measuring if the respondents' favor unification with China when the economic, political and social conditions are the same. All the answers agree with unification are coded as 1, while 0 is attributed to the answers expressing disagreement. Other responses are dropped. Model #2 and Model #4 incorporate four interaction terms between ECFA and Party Affiliation, as described in the previous section.

I will devote most of this section to the interpretation of the major variables. The first two columns in the table are based on the first measure of the respondents' opinions about unification or independence, coded on a 0-10 scale. Column 1 reports results for a linear regression model (Model #1) that includes only the key independent variables and the control variables, while column 2 reports the results for a similar model (Model #2) with the addition of the interaction variables between the two groups of the key independent variables.

The results in these two columns show that positive influence of ECFA on Taiwan's economy would sway public opinion in Taiwan to be more in favor of unification, but similar effects have not been observed from the influence of ECFA on the Taiwanese public's personal economic conditions. Compared to perceiving a negative impact of ECFA on the economy, a positive influence will translate into 0.75 unit of moving towards unification on the 11-point scale. This number will be 1.1 in Model #2, representing a potentially larger effect. Thus, the variable representing the effects of ECFA on Taiwan's economy provides evidence for my first hypothesis that Taiwanese people will be more likely to support unification if they perceive a better economy in Taiwan

as a result of ECFA.

At the same time, party identification of respondents is relevant to the opinions about cross-strait relations. Compared to respondents who are not affiliated with any of the two political camps, those identifying themselves with the blue camp are more supportive of unification, while those who support the green camp show more support for the independence of Taiwan. In combination, partisan affiliations could generate a change of 1.7 units on the 11-point scale. When the interaction variables are considered, although the significance level of the *Blue Camp* variable drops, the impact of party identification with either party camp on favoring independence or unification increases; namely, respondents who break away from the green camp to join the blue side are more likely to support unification with China by nearly 3 units on the 11-point scale.

Based on the ECFA variables and party identification variables, the interaction variables tell a more nuanced story of how the influence of ECFA works on different party members. The first two variables show that the influence of ECFA on Taiwan's economy impacts opinions about independence or unification These impacts are not conditional on the respondents' party identifications.

The next two interaction variables begin to show the difference of the influence of ECFA among the supporters of the two major political camps. Among the blue camp supporters, the effect of ECFA on personal economic conditions does not depend upon their party affiliation as compared to those who are politically unaffiliated. Among the green camp advocates, however, the effect of ECFA on personal economic conditions does depend on affiliation. The fourth interaction variable indicates that for a supporter of the green camp, personally benefiting from the ECFA would translate into less support for the independence of Taiwan. In combination, the third and the fourth interaction terms show that improved personal economic conditions as a result of ECFA would create more incentives for the green camp supporters to be more in favor of unification with China than the blue camp supporters. Therefore, the results shown by the third and the fourth interaction variables support my second hypothesis that perceived economic benefits of ECFA would lead to more support for unification with China among the green camp supporters than the blue camp advocates.

Columns 3 and 4 in Table 2 test my hypotheses using the second measure, a dummy variable of the respondents' opinions about unification when the socio-economic conditions between China and Taiwan are the same. Columns 3 and 4 report the results of two probit regressions, with column 4 incorporating the interaction variables.

In Model #3, the perceived influence of ECFA on Taiwan's economy has statistically significant impacts on the respondents' preferences about cross-strait relations. Respondents who perceive that the Taiwanese economy gets better as a result of ECFA are more likely to support unification with China when the socio-economic conditions on both sides of the strait are the same. However, concerning the impact of party affiliation, respondents who identified with the blue camp are more likely to support unification, while the impact of party affiliation is not statistically significant for the green camp supporters. Yet, as shown in Model 4, these results lose statistical significance when the interaction variables are introduced.

The lack of statistical significance in the results shown in the third and fourth models may be due to the phrasing of the question and the operationalization of the dependent variable in these two models. The question asked if respondents would agree with unifying with China if economic, political and social conditions are the same on both sides of the strait. It is worded to urge respondents to choose a side on this issue, therefore overlooking or disregarding the fact that the majority in Taiwan is not in favor of either independence or unification. At the same time, it is important to note that my operationalization method might have decreased the statistical significance. Due to the small number of respondents who strongly agree and strongly disagree with the statement, I chose to join these two extreme categories into the larger categories of "agree" and "disagree" respectively. The reclassification might have blurred the nuanced differences of various respondents' positions on the issue of cross-strait relations.

Overall, the statistical results, especially shown in the first two models, are supportive of the hypotheses proposed in this study. This suggests that the perceived economic benefits of ECFA would sway public opinion in Taiwan in favor of unification with China, but the effects among the blue camp supporters differ from that of the green camp supporters.

Conclusion and Implications

This research paper began with curiosity about China's economic influence on public opinion in Taiwan regarding the critical issue of independence of Taiwan and unification with China. ECFA, a preferential trade agreement signed in June 2010 between China and Taiwan, is a mechanism through which to explore this relationship. Based on *Taiwan Presidential and Legislative Elections Survey 2012*, my study has shown that ECFA is a potential channel of economic influence from China on public opinion in Taiwan. Public opinion is more supportive of unification with China when the economic conditions are perceived to be better as a result of ECFA. More importantly, the effects of ECFA described above have higher statistical significance among the green camp supporters, who favor the independence of Taiwan more than the blue camp supporters.

This study has several implications. First, I indirectly tested the effectiveness of China's cross-strait policy. As mentioned in the *Historical Background and Theories* section, policy makers in Beijing who perceive the potential of a large and continuously growing economy now focus on influencing the other side of the strait through cross-strait economic activities. In addition to the growing stake for policy makers in Taipei, my study shows that economic ties could exert significant influence on public opinion to make the claim of Taiwan's independence less favorable.

Second, my findings are relevant to party politics in Taiwan. The support for the pan-green camp could be potentially swayed by the economic influence from the Mainland. For a political party, the key to success in a democratic society is to appeal to the voters. When this universal rule is applied to Taiwan, it is clear that the political parties should react to the voters' changing preference on key issues, such as cross-strait relations in Taiwan. As economic influences from China have more significant effects on the supporters of the parties that strive for an independent

Taiwan, the position of claiming independence of Taiwan would become less attractive. This would lead to the stable cross-strait relations maintained at the status quo and increased incentives for the parties in the green camp to reposition.

Third, this research paper has a methodological implication for survey studies. Asking respondents to choose a side in issues as sensitive and complicated as the cross-strait relations may lead the researchers to neglect some nuanced differences of respondents' positions, and may also explain the unsubstantial and insignificant income variable in the two probit regression models. It has been pointed out that ambivalence towards controversial issues, such as gay rights and abortion, is prevalent in the US, and that survey questions (which provide the opportunity for open-ended responses) may more accurately measure individuals' attitudes.[24] [25] [26] In this case, the effectiveness of different methods of measuring public opinion about cross-strait relations in Taiwan could be relevant to literature on survey researches.

Beyond my study, much work remains to be done to track the influence that ECFA or other channels might have on public opinions in Taiwan over time. As the imbalance of power between China and Taiwan persists and grows, their shared prosperity will become increasingly more crucial for regional stability, and deserve more academic attention.

Appendix

A. Questions

Question 1: 11-point scale measuring opinions about independence and unification
Sometimes people will talk about the question of Taiwan's independence or the unification with China. Some people say that Taiwan should declare independence immediately. Others say that Taiwan and China should unify immediately. Still others have opinions between these two positions. This card lists eleven positions from independence (0) to unification (10). Which position do you occupy? ___Points. (95 refuse to answer; 96 it's hard to say; 98 don't know)

Question 2: Unify if conditions are the same
Some people say, "If the economic, social and political conditions were about the same in both Mainland China and Taiwan, then the two sides should unify." Do you agree or disagree with this statement? 01 strongly agree; 02 agree; 03 disagree; 04 strongly disagree (95 refuse to answer; 96 it depends; 97 no opinion; 98 don't know)

Question 3: Unify if a gap of conditions exists
Some people say, "Even if the gap between the economic, social and political conditions in Mainland China and Taiwan is quite large, the two sides should still unify." Do you agree or disagree with this statement? 01 strongly agree; 02 agree; 03 disagree; 04 strongly disagree (95 refuse to answer; 96 it depends; 97 no opinion; 98 don't know)

Question 4: The influence of ECFA on Taiwan's economy
After signing the cross-Strait "Economic Cooperation Framework Agreement" (ECFA), do you think Taiwan's economy has gotten better, worse or is about the same? 01 get better; 02 get worse; 03 stay about the same (95 refuse to answer; 96 it depends; 97 no opinion; 98 don't know)

Question 5: The influence of ECFA on personal economic conditions
Thinking about your own economic situation, do you think it has gotten better or gotten worse as a result of ECFA, or stayed about the same? 1 get better; 02 get worse; 03 stay about the same (95 refuse to answer; 96 it depends; 97 no opinion; 98 don't know)

Question 6: Party affiliation
Which party (that you think of yourself as leaning toward among KMT, DPP, NP, PFP, and TSU) is that? 01 KMT; 02 DPP; 03 PFP; 04 NP; 06 TSU; 07 Green Party Taiwan (GPT); 08 Communist Party (98 don't know; 99 skip)

Question 7: Education: 15 options included

Question 8: Year of birth: ___ (90 omit)

Question 9: Monthly household income
Monthly household income: 01 under 25000; 02 25001-36000; 03 36000-45000; 04 45001-55000; 05 55001-64000; 06 64001-75000; 07 75001-87000; 08 87001-100000; 09 100001-130000; 10 over 130001(95 refuse to answer; 96 it's hard to say; 98 don't know)

Question 10: Mother's ethnic background: 21 options included

Question 11: Father's ethnic background: 17 options included

B. Coding of Control Variables

Education
0: Literate but no formal schooling; 1: some primary school, primary school graduate; 2: some junior high school, junior high school graduate; 3: some high school or vocational school, high school or vocational school graduate; 4: some technical college, technical college graduate, some university; 5: university graduate; 6: postgraduate education; NA: else

Age:
1: 20-29; 2: 30-39; 3: 40-49: 4: 50-59: 5:60-69:6: 70-100
Income
1: under 25000; 2: 25001-36000; 3: 36001-45000; 4: 45001-55000; 5: 55001-64000; 6: 64001-75000; 7: 75001-87000; 8: 87001-100000; 9: 100001-130000; 10: over 130001;
NA: else

Ethnicity
Based on the answers to Question 10 and 11, the number of mainlanders among the respondent's parents is taken as the value for this Ethnicity variable, constructing a scale of 0 to 2.
C. Multicollinearity Check
In my models, the variance inflation factors for all the independent variables except for the interaction terms are below 2, meaning the hypothesis that there is a problem of collinearity could be rejected.

Table 3 Collinearity Check—Variance Inflation Factors

	Linear Regression Model	Probit Regression Model
ECFA		
Influence on Taiwan's economy	1.592	1.561
Influence on personal economic situation	1.269	1.267
Party Affiliation		
Blue Camp	1.995	1.921
Green Camp	1.812	1.740
Education	1.285	1.287
Age	1.253	1.250
Income	1.182	1.184
Ethnicity	1.149	1.139

Source: Taiwan Presidential and Legislative Elections Survey 2012, from Taiwan Election and Democratization Studies

D. Alternative Coding for Model 3 and Model 4

In order to further discuss the impact of my coding decision on the significance levels of key variables without generating unnecessary distraction, here, I modify the coding of the dependent variable, based on Question 2 in Section A of the Appendix. The four valid answers are transformed into a scale of four, with 1 for "strongly agree" and 4 for "strongly disagree". Accordingly, the new regression models corresponding to Model 3 and Model 4 in Table 2 would become linear regression models.

In Table 4, compared with Model #3 and Model #4 in Table 2, the most discernible changes in results appear in *Green Camp*, where the significance levels have raised. Both in Model #5 and Model #6, the results indicate that respondents who identify with the Green Camp would be less likely to support the position of unification than those who are not affiliated with the two political camps. At the same time, note the last interaction term, a statistically significant number showing that members of the green camp who perceive themselves as benefiting from ECFA tend to view unification as slightly more attractive, or less repulsive. Though these results are not inconsistent with my hypothesis, they do not provide much support either. On the one hand, there is no statistically significant result for the *Blue Camp* variable; on the other hand, even on a 4-point scale, the impact of the aforementioned results is still limited.

Lastly, when these two alternative models are compared with the two probit models in Table 2, it is discernible that the influence from margins on both sides is better captured. Otherwise, there would have been no subtle increase in significance level of the last interaction term. Therefore, this section tentatively demonstrates that my previous coding decision, as denoted in Model #3 and Model #4, unfortunately dismissed some variance among the answers from respondents. However, due to the distribution of extreme answers (55 "Strongly Agree" and 144 "Strongly Disagree" among 1175 entries), my claim could not yet be conclusively established.

Table 4 Alternative Models on ECFA's Effects on Public Opinion in Taiwan about Independence or Unification

	Favouring Independence or Unification	
	Model #5	Model #6 (With Interaction Terms)
Intercept	2.947*** (2×10^{-16})	2.914*** (2×10^{-16})
ECFA		
Influence on Taiwan's economy	-0.116*** (0.0009)	-0.120. (0.0906)
Influence on personal economic situation	-0.022 (0.6672)	0.038 (0.7179)
Party Affiliation		
Blue Camp	-0.076 (0.1634)	-0.025 (0.8709)
Green Camp	0.191*** (0.0005)	0.232. (0.0810)
Interaction		
Blue × ECFA Economy		0.057 (0.5257)
Green × ECFA Economy		-0.063 (0.4955)
Blue × ECFA Personal Economic Situation		-0.143 (0.2763)
Green × ECFA Personal Economic Situation		0.223* (0.8728)
Education	0.010 (0.3809)	0.008 (0.4626)
Age	-0.100*** (3×10^{-5})	-0.065*** (1.68×10^{-5})
Income	0.003 (0.6105)	0.003 (0.6842)
Ethnicity	-0.050 (0.2141)	-0.044 (0.2406)
N	1175	1175

.p < 0.1 *p < 0.05 **p < 0.01 ***p < 0.001

Standard errors are in the parentheses.

Source: Taiwan Presidential and Legislative Elections Survey 2012, from Taiwan Election and Democratization Studies

Note:

Model #5 and Model #6 use Linear Regression Model, based on a 4-point scale measuring if the respondents' favor unification with China when the economic, political and social conditions are the same. 4 is assigned to "Strongly Disagree", 1 to "Strongly Agree", and the other two less extreme answers in between. Other responses are dropped.

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It's Alright, Ma (You're Only Bleeding)

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In Alfred Hitchcock's *Psycho* (1960), the murderous and mother-obsessed Norman Bates tells the heroine Marion Crane, "A boy's best friend is his mother." While this line has become almost as iconic as the film itself, the fact that it appeared in what many consider to be one of the first mainstream slasher films makes it seem as prophetic as it is iconic. Many slasher films revolve around the character of an adult, abandoned as a child, whose obsession with his mother causes him to seek out female victims and, in the tradition of the slasher film, stab them to death. Although the origins of the "murderous abandoned child" can be traced back to *Psycho*, the character came into its own during the early 1980s wave of slashers; films such as William Lustig's *Maniac* (1980) and Robert Hiltzik's *Sleepaway Camp* (1983) presented audiences with slashers who were abandoned by their parents and who serve as the viewer's main point of identification, allowing audiences to explore the slashers' compulsion to penetrate the female form. This is an incredible departure from films like Tobe Hooper's *Texas Chainsaw Massacre* (1974) where audiences were meant to identify with groups of teenagers and never given a glimpse into the mind of the killer. Because the audience is aware of the reverential relationship that the slasher has with his absent mother, the act of slashing suggests an attempt to reestablish a connection with the womb and reenact his birth, perpetuating the abject relation to the maternal as mentioned in Barbara Creed's "Horror and the Monstrous Feminine: An Imaginary Abjection." In her essay, Creed argues that the maternal function has become associated with the abject because of the dominant paternal or symbolic order, a dynamic that suggests the slasher's desire to be reborn may, in fact, be symptomatic of a need to move away from the maternal order and towards the symbolic.

Before delving into the implications of the slasher penetrating feminine bodies, a psychological framework must be established in order to understand the "the abandoned child." In Otto Rank's *The Trauma of Birth*, Rank expands Freud's theory of the repression of birth and what purpose it serves in human development. Rank believes that the "rebirth phantasy," a common occurrence in which the patient fixates upon the psychoanalyst and assigns them a parental role, is evidence of the patient's continued fixation on his or her mother; writing, "It became clear to me that the strongest resistance to the severance of the libido transference at the end of the analysis is expressed in the form of the earliest infantile fixation on the mother" (Rank 4). From here, Rank theorizes that patients who are affected by the birth trauma are compelled to continually reenact their birth and align themselves with the intrauterine. This, Rank writes, is an attempt by the patient to free himself from the maternal by recreating the act that imparted the anxiety of separation, therefore "[mastering] the birth trauma" (Rank 5). Rank observes, however, an inherent danger in the rebirth phantasy, writing, "Naturally the patient constantly shows the tendency behind all his resistances to prolong indefinitely the analytic situation which yields him such considerable satisfaction" (Rank 9-10). In other words, the act of aligning oneself with the intrauterine is so enjoyable that individuals prolong the rebirth phantasy, indefinitely postponing the stage where they separate from their mother and become autonomous.

This theory complements John Bowlby's expansion of Anna Freud's findings on separation anxiety and long-term abandonment. In *Separation: Anxiety and Anger*, an in-depth examination of separation anxiety and Freud's theories on the subject, Bowlby describes Freud's concern that finding a surrogate mother for a child who has been abandoned by his parents is a near impossibility. This assertion is based on a study conducted by Anna Freud and Dorothy Burlingham during World War II in which they observed the behavior of children who were left and raised in a residential nursery. The nurses soon acted as surrogate mothers for the children, and Bowlby describes the relationship, writing, "Each nurse could care for her own little group of children… the children became strongly possessive of their nurse and acutely jealous whenever she gave attention to another child" (Bowlby 3). During Freud's study, it became clear that children who were abandoned sought out surrogate mothers, often resulting in either a heightened possessiveness or open aggression if the child found his surrogate unsatisfactory: "[The children] were also unusually prone to become hostile towards [their surrogate] or to reject her, or else to retreat into a state of emotional detachment" (Bowlby 4)."

While this is not always the case, Bowlby points out that a significant number of abandoned children exhibit these qualities

and often develop into highly neurotic or troubled adults (Bowlby 5-6). Indeed, in one particular study, conducted by Christoph Heinicke and Ilse Westheimer, it was revealed that separation anxiety is inordinately linked to the mother, causing children to continually call out for her or, in some cases, actively search for her. One child, who was particularly shaken, described as refusing to even accept the possibility of separation from her parents, was unwilling to take off her coat and after "[nodding] off from sheer fatigue… awoke screaming for Mummy" (Bowlby 8). After a period of time, however, even the most affected child began scouting for a surrogate, eventually connecting with her in ways that he or she would with his or her real mother, apparently seeking "some sort of reassuring or affectionate response from [their surrogate]" (Bowlby 9).

It is from the intersection of these two theories that the character of the abandoned child, as seen in the slasher film, takes shape. According to N. Blandin, PJ Parquet, and D. Bailly of *The Centre d'Information et de Traitement des Dépendances,* both Sigmund Freud and Bowlby's theories on birth trauma and separation anxiety are rooted in the supposition that the connection to the mother is instinctive (Blandin n. pag). This means that separation anxiety is not a learned behavior where one has to be conditioned to feel connected to the maternal, but rather is "genetically programmed" and can be experienced regardless of how much contact an individual has with one's mother. This is not the only place where the two theories seem to be in conversation with one another; in both Rank and Bowlby the individual who has not properly separated from his or her mother seeks out a surrogate, whether it is an actual maternal figure or a psychoanalyst. In the cases described by Bowlby where the child attempts to reject his surrogate, we see shades of Rank's rebirth phantasy, where the shift from hyper-possessiveness to the almost uncontrollable need to separate mimics the behavior of the patients who actively reenact the birth process, starting in the womb and eventually working towards their rebirth. Because of the various ways that the theories overlap, it would not be so farfetched to suggest a fusion of the two, where an individual seeks out a surrogate maternal figure in order to fulfill both the "rebirth phantasy" as well as the need for maternal authority, as expressed by the abandoned children.

A film that may be helpful in examining how this figure translates into horror cinema is Ridley Scott's sci-fi slasher, *Alien* (1979). Set in the distant future, a space crew, aboard the appropriately named spaceship "Mother," lands on a foreign planet in order to investigate what they believe to be a distress signal. Upon landing, the crew finds a spaceship that contains a room full of abandoned alien eggs. One of the crewmembers, Kane, examines an egg and is attacked by the "face-hugger," a crab-like alien that impregnates him with an alien child which later bursts from his chest. Kane's "child" develops into an adult almost instantaneously and terrorizes the rest of the crew, using its body to penetrate each member until Ripley, the film's heroine, expels the alien from the ship.

Before venturing into the mechanics of how the alien and its desire to attack the crew operates in terms of rebirth phantasy, it is first necessary to examine the situation of its birth and how it could potentially be related to separation anxiety. Because the "face-hugger" is the impregnator and the human body houses the alien until it is born, it seems that the distinction between human males and females is almost infinitesimally unimportant when discussing the maternal body. To the alien, each body on the ship would be a maternal body because of the way Kane serves as an incubator for the face-hugger's seed, much like in human pregnancy when the woman acts as the vessel through which the child is carried and eventually expelled. Therefore, the fact that Kane is a male and not a female does not matter when exploring the relationship between the abandoned child that is the alien and what he would consider to be the maternal body.

From here we can see that after Kane, who carries out the maternal function, dies, and the alien baby is left with no parents, and is, for all intents and purposes, an abandoned child. With this in mind, the alien's pursuit and subsequent murder of the crewmembers takes on an entirely new dimension. Placing the behavior of the alien within Bowlby's framework, its desire to hunt the crew seems to parallel the abandoned child's desire to seek out a surrogate mother to bond with. Indeed, like the children described by Bowlby, the alien seems fixated on the prospect of reuniting with the maternal function and largely ignores the only non-human creatures on the ship, Ash the android and Jonesy the cat. While this may seem insignificant at first glance, Ash and Jonesy are frequently in the same space as the other human characters, yet are never followed or captured by the alien, who instead opts to hunt the human crew. If the alien truly were hunting the creatures aboard the ship solely because of predatory instinct, it would not seem so discriminate. After all, why only kill the largely harmless Brett when Jonesy exists in the same space? Similarly, why is Ash the only crewmember, besides the lone survivor Ripley, to not be killed by the alien, but, rather, by his shipmates? It seems as though the alien's blatant disinterest in the non-human bodies on the ship indicates that it is not necessarily an inborn violence or predatory instinct that is driving him to penetrate the crew, but, rather, a desire to rejoin with the maternal body, a feat that is only possible through interacting with the human crew.

But if the alien's goal is to reunite with the maternal body, why kill it instead of merely bonding with it? To answer this, one only needs to examine the alien's method of killing the crewmembers: penetration. Indeed, the alien literally takes its body and attempts to shove it inside of his surrogate mother, allowing him to reenter the maternal body, and, by extension, the womb. The alien's desire to reclaim its position inside of the maternal body is the ultimate form of bonding; like the patients in Rank's studies who fixate upon the psychoanalyst and attempt to mimic the intrauterine stage, the alien's desire to rejoin with the mother is so strong that it physically manifests by forcing itself inside of the maternal body, realigning itself with the intrauterine stage.

Through this realization, it becomes clear how the alien fulfills Rank's rebirth phantasy. The pattern of the alien's murders seems to play out as follows: locate the victim, penetrate the maternal body, and, lastly, sever that connection shortly thereafter. As has been established, the alien's pursuit of the crew seems to align with the search for a surrogate while the penetration manifests the desire to reenter the womb, and the final act, removing itself from the maternal body, mimics the actual birth of the alien. Even if one ignores the implications of the alien physically removing itself from the maternal body, the visual parallels between the post-

penetration and post-birth bodies certainly suggests a relationship between the two. Upon removing itself from the maternal body, the alien leaves a large hole in its victim's body, leaving him or her completely bloodied. This becomes particularly apparent during the death of Parker, the first onscreen victim, besides Kane. When the alien kills Parker, the penetration is not only visible, but the cavity that the alien imparts in his chest is also shown as well, though not without the alien inside of it. At this moment the parallels between the post-birth physicality of Kane and that of Parker become indistinguishable. Both bodies are left terribly bloodied and hollow after their encounter with the alien, creating a parallel between the way the alien is born and the way that it kills the crewmembers. It is also interesting to note that during the murder of Lambert, which is only demonstrated through audio, her screaming and panting is not different from the behavior of a woman giving birth, or even that of Kane, who constantly screams until the alien is born. Indeed, it seems as though by removing itself from the maternal body, the alien is reenacting its own birth, therefore fulfilling the rebirth phantasy.

But with this realization, another question arises: with the resolution of the rebirth phantasy, why does the alien continue to reenter different maternal bodies? While at first this may seem incredibly problematic, the answer is actually embedded in the book by Rank. When outlining the dangers of rebirth phantasy, Rank discusses how the psychoanalyst must actively facilitate the successful rebirth, for fear that the patient will not come to terms with his separation from the mother and reenter the intrauterine, what he asserts gives the patient the most satisfaction (Rank 9-10). Without a facilitating force or inherent desire to separate from the mother, it seems as though the rebirth is likely to fail. The resolution of *Alien* acknowledges this, establishing Ripley as the agent of the alien's death and expulsion from the womb.

What exactly does this framework do for the traditional horror slasher? After all, *Alien* is certainly not the traditional slasher film and is missing several elements that seem to define the genre and most of the theory surrounding it: a human murderer who uses sharp objects to penetrate the feminine form. Even if it was to be embraced as a standard slasher, *Alien* is so obsessed with unnatural births that it is set apart merely because of its subject matter, which, as Carol Clover argues in her essay "Her Body, Himself: Gender in Slasher Films," is far more concerned with the hierarchy of sexual power than rebirth. In fact, Clover would likely argue that identifying most females in slasher films as potentially maternal would be a grave mistake. In her essay, Clover asserts that the slasher pursues the "final girl," her term for the inevitably female gendered survivor, not because of the maternal potential that he sees in her body, but, rather, because the abject terror expressed by the survivor is only suitable because of her gender. She goes on to argue that the final girl expresses prototypical male characteristics while the slasher exists in a kind of genderless flux, resulting in a male identification with the final girl and her phallusization when she "expels the killer from the narrative" (Clover 77-86).

This observation is far from wrong, but only takes into account the slasher films where a final girl is clearly present and the true motive of the slasher is not fully developed. For slashers such as Michael Myers in *Halloween*, Clover's theory fits precisely because of the lack of characterization and clear intention on the part of the slasher. The film also goes to great lengths to keep the audience in the same space as the final girl and create shifts in viewer identification, as Clover smartly points out. This is why it would be fair to read *Alien* through Clover's analysis of the slasher; Ripley clearly embodies the final girl, and the alien, though admittedly phallic, has no human gender, allowing the male viewer to take pleasure in Ripley's feminine terror and identify with her "masculine resourcefulness." In films where this is not the case, however, the slasher's motivation and what "slashing" represents to the killer becomes far more important. Indeed, Clover never even attempts to locate the role of the feminine in films where the slasher is the main character or cases where the final girl never makes her appearance. In addition, she ignores slashers that do not allow identification with anyone other than the killer. What is the viewer to make of the slasher and his relationship to his victim in cases such as these? This is precisely the question that is so central to films where the slasher is characterized as an abandoned child and why Clover's analysis is inadequate when approaching these films. In order to understand the slasher, one must understand the act of slashing and how it relates to the desire to enter the female body.

This is why the framework of rebirth phantasy established in *Alien* can be translated into other, more traditional slasher films. The alien's desire to enter the maternal body, while never made explicit, seems to mirror the behavior of several slashers and, in some cases, is a narrative facet in the film itself, an example being Hitchcock's *Psycho*. The film initially positions the viewer with Marion Crane, who has just stolen a large sum of money from her employer and is on the run from the law when she meets Norman, the film's slasher. Norman runs the Bates Motel and takes care of his extremely controlling mother, quickly earning him the sympathy of both Marion and the audience. Marion is then killed by someone whom the audience believes to be Norman's mother, and the rest of the film revolves around various characters trying to unravel the mystery of Marion's death-- only to discover that Norman killed her while wearing his mother's clothes. The film ends with Norman being completely suppressed by his mother's psyche, which he developed in order to reject her death, doomed to inhabit his own body without agency within it.

At a narrative level, it seems as though Norman is very much like the child, as described by Bowlby, who refused to accept her parents' departure, continuing to wear her coat and shoes as if expecting her parents to return at any moment. Unlike the child, however, Norman wears his mother's clothes, which, while suggesting a denial similar to that of the child, externalizes his desire to merge with the maternal form and reenter the womb. On the surface, Norman attempts to coat himself in the maternal body by wearing his mother's dress, wig and speaking in her voice, which feeds his refusal to accept her death and allows him to return to the position of the intrauterine. Judging from Norman's attire during the murder of Marion, it seems as though Norman does not want to separate himself from his mother, but, rather, become far closer, potentially upsetting the framework of rebirth phantasy and indulging in womb phantasy in its stead. Norman, however, vocalizes almost the opposite desire, telling Marion that he feels as though he is caught inside of his own "private trap," demonstrating the desire to escape his oppressive mother and seize his autonomy, and while it is true that he almost immediately

retreats from this statement, it would be difficult to completely ignore it or deem it superfluous.

In fact, it is during this conversation that Norman's relationship to the female form is developed and the audience learns of Norman's penchant for stuffing birds. His hobby alone suggests an obsession with shoving himself inside the female form because of the constant comparisons that are drawn between Marion, whose surname is not so coincidentally Crane, and the stuffed birds that surround her. But it is perhaps Norman's language when discussing the "hobby" that is most telling: "It's more than a hobby. A hobby is supposed to pass the time, not fill it." As if the nature of the hobby, which is to replace the insides of birds in order to preserve them, is not suggestive enough, Norman goes a step further and openly associates the hobby with the act of "filling," which certainly relates to the desire of the slasher to reclaim his spot in the now empty womb.

In addition, the audience is exposed to Norman's complicated feelings about his mother, whom he fantasizes about leaving but stays with out of loyalty. Norman's resentment of his mother comes to a head when he tells Marion, "I think that we're all in our private traps, clamped in them, and none of us can ever get out. We scratch and we claw, but only at the air, only at each other, and for all of it, we never budge an inch," and then follows this statement by declaring, "I was born in [my trap]." It is difficult to ignore the parallel between Norman's description of a "private trap" and the vaginal imagery. Norman's admission that he was born in his trap strengthens the association and paints the womb as a kind of prison from which Norman is desperate to escape. Certainly the word "clamped" evokes the image of a child attempting to separate from the maternal body, only to be held in place by the mother's vagina. And what is interesting about the juxtaposition of the vagina and what seems to be a bear trap is the association of violence and restrictiveness with the maternal body, which validates Norman's desire to escape.

Yet if Norman wants to fulfill the rebirth phantasy and separate from the maternal body, why does he, prior to any of the killings, coat himself in his mother's clothes? In order to explore this, it is necessary to examine Marion's murder and the function that her death serves for Norman. Before Marion's death, Norman spies on her through a peephole, admiring her naked body before returning to the house, most likely, in order to dress himself in his mother's clothes and obtain a suitable weapon. Norman then returns to Marion's room, stabbing her several times while she screams and her blood mixes with the water surrounding her feet.

As in *Alien*, the screaming and flow of blood evoke birth imagery, demonstrating Norman's attempt to undergo a rebirth of his own. Unlike the alien, however, Norman has no way of physically entering the maternal body because, as a human, he lacks the penetrating capability that the alien demonstrates. This is where the slasher's weapon becomes extremely important. In Clover's essay, she establishes the killer's weapon as an extension of himself, asserting that the knife is an extension of the killer's ambiguous masculinity and therefore a kind of surrogate penis, establishing the killer's "phallic purpose" by plunging into the "trembling bodies of young women" (Clover 80). While Clover sees "phallic purpose" in the killer's weapon, in situations where the slasher is attempting to rejoin with the maternal body, it seems far more likely that, like the penetration in *Alien*, the killer is actually using the knife to reconnect with the maternal body, rather than to express his sexual frustration with it. In addition, her suggestion that the wound acts as a kind of surrogate vagina that the slasher creates through penetrating "young female bodies" is easily applied to the desire of the abandoned child to enter the female body. With the infliction of these seemingly vaginal wounds upon the female form, the slasher mimics his own birth and fulfills the rebirth phantasy upon removing his blade by recreating the bleeding vaginal cavity that he initially emerged from.

By establishing the knife as an extension of Norman, it seems as though his actions line up with that of rebirth phantasy. By penetrating Marion's body, Norman is able to reconnect himself to the maternal, taking the knife and placing it firmly inside of Marion, causing it to become an extension of her as well. It is here that the knife is revealed to be a kind of umbilical cord that allows for the slasher to reestablish his connection to the maternal body. In addition, because Marion is naked throughout the scene, her identity is essentially reduced to that of her feminine form, making Norman's entrance into her body less about penetrating Marion, as the audience knows her, and more about inhabiting her physicality. With this established, Norman's attire takes on a new dimension, independent of his desire to reenter the womb. By cloaking himself in his mother's clothes while he murders Marion, Norman strengthens the connection between the act of removing the knife with the act of evacuating the maternal body. After severing his connection to Marion's body, he immediately leaves the bathroom and removes his mother's clothes, no longer inhabiting the maternal form. By doing this, Norman doubly distances himself from the maternal form, mimicking his own birth through the murder of Marion and separating himself from his mother by casting off her clothes in favor of his own.

Unfortunately, Norman's rebirth is unsuccessful, and, at the end of the film, he is completely subservient to his mother, whose psyche has trampled his own, permanently relegating him to the intrauterine. It is here that the viewer gains an insight into the potential consequences of not being able to "master the birth trauma." Norman's fate ultimately communicates the danger of the rebirth phantasy that Rank describes, which leads to individuals never truly separating from their mother and, instead, staying in the intrauterine phase. By allowing his mother to take control of his body, Norman gives up all hope of escaping his "private trap" and is forever trapped in the womb.

While the rebirth phantasy is clearly present in both *Alien* and *Psycho*, its implications are still relatively unexplored. Both films portray the relationship between mother and child as highly unnatural and go as far to suggest that an overbearing mother is nearly as monstrous as her murderous offspring. Even the child's desire to separate from the mother marks the maternal as something to be avoided, an idea that is clearly expressed in film theorist Barbara Creed's "Horror and the Monstrous Feminine: An Imaginary Abjection." In her essay, Creed argues that the role of the mother in both society and media is abject and that the relationship between the mother and child becomes complicated when the child attempts to break away from the mother. "The position of the child is rendered even more unstable because, while the mother retains a close hold over the child, it can serve to authenticate her existence – an existence which needs validation

because of her problematic relation to the symbolic" (Creed 72). In other words, the mother's association with blood, an association drawn from the scene of birth, and other abjections such as feces, which is because of the mother's part in "potty training," cause her to exist in a powerless state that motivates her to find meaning through her child. Therefore, when the child attempts to separate from the mother and enter, what Creed calls, the "symbolic" or "paternal" order, the mother's existence is threatened and she exerts even more control, attempting to stop this transition and keep the child dependent upon her.

It is not too difficult to see how Creed's theory and rebirth phantasy could work hand in hand. In the slasher film, the child's attempt to escape the mother is embodied by his reenactment of his own birth, and even the failure of the rebirth seems to coincide with Creed who states, "The child finds it easy to succumb to the comforting pleasure of the [mother-child] relationship" (Creed 72). Through Creed, it becomes clear that the maternal presence that haunts these slasher films is what prevents the slashers from entering the symbolic order, resulting in damaging psychological consequences and violence once separated from the maternal. This is certainly present in *Psycho*, where Norman seems desperate to separate from his mother, yet cannot grasp his autonomy because of his dependence upon her. Because of the overbearing maternal presence that shaped his adult life, once abandoned, Norman cannot reconcile how to enter the symbolic order because he never left the womb in the first place, causing him to, unsuccessfully, reenact his own birth in an attempt to seize his individuality and enter the symbolic order.

This raises the question of whether abandoned children can ever truly escape the womb and enter the symbolic order. In both *Alien* and *Psycho*, neither slasher exhibits a strong enough desire to overcome the need for maternal authority and either has to be forcibly ejected from the womb, dying in the process, or remain contented to inhabit it, essentially being erased by the maternal presence. In the case of Hiltzik's *Sleepaway Camp*, however, the viewer is given a slasher who initially submits to the maternal order, but, over the course of the film, develops an urge to escape it, resulting in a successful rebirth. The film follows Angela Baker and her cousin Ricky who leave Ricky's mother, Aunt Martha, to go to summer camp. Soon after they arrive, an unknown individual begins to systematically murder campers and staff, but the deaths are written off as accidents. Meanwhile, Angela struggles with her inability to interact with the other campers and to become intimate with Paul, Ricky's best friend, who is romantically interested in Angela. This anxiety stems from Angela witnessing her father and brother being run over by a speedboat as a young child as well as the trauma of seeing her father have intercourse with another man. The film concludes with the remaining campers and staff discovering a naked Angela, who is revealed to be a boy forced to assume the identity of a girl by Aunt Martha, holding Paul's severed head, revealing Angela to be the killer.

Indeed, the gender roles in Hiltzik's *Sleepaway Camp* are somewhat of a puzzle. Upon first viewing, Angela's reluctance to sexually engage with Paul seems to align with Clover's assertion that the final girl cannot have intercourse because she is a point of identification for a predominantly male audience. But when the viewer watches the film a second time, aware that Angela is actually a male forced to assume the role of a female, her avoidance of sexual contact seems driven by an anxiety over the gender assigned to her by Aunt Martha, her surrogate mother, as well as a kind of homophobia surrounding her departed father. With this in mind, the resolution of the film, where a naked, blood-soaked Angela wordlessly gawks at the camera, suggests a literal rebirth and escape from the influence of Aunt Martha, meaning that Angela successfully escaped the womb of her own accord, unlike the alien and Norman.

But Angela's desire to shed her feminine identity and rebel against the maternal is not immediately present, which is made clear in both the opening and the conclusion where a flashback reveals Martha telling Peter, a young Angela, that he would assume the role of a girl. When the viewer is introduced to Angela and Aunt Martha, the latter is incredibly overbearing and supportive, frequently touching Angela and calling her an "angel." Even upon saying goodbye to her own son, she shows far less passion than she does towards Angela, merely kissing Ricky on the cheek while she embraces Angela for an uncomfortable amount of time. Angela wordlessly accepts this praise, and remains expressionless throughout the scene, underscoring her complete passivity when faced with the maternal order. This, of course, is explained later in the film when it is revealed that after the death of her father, Angela is sent to live with Aunt Martha who exchanges her affection for Angela's swapping of genders.

Because of this, it is not difficult to draw a connection to Bowlby, who describes similar behavior in abandoned children, who latch on to surrogate mothers, becoming extremely possessive and needy. Angela's behavior also seems to mimic that of Rank's patients who have entered the intrauterine stage, relinquishing all control to their surrogate. This, of course, is nothing new; both Norman and the alien attain this state rather easily. What is different in the case of Angela, however, is that as the film progresses, the womb becomes a space devoid of pleasure. Like Norman, Angela externalizes her place in the womb by assuming the feminine body as her own, containing her identity as a man within her constructed female visage. At the beginning of the film, Angela's adoption of the female form has few adverse effects and only gains her the affection of her surrogate; once at camp and surrounded by sexually active teenagers, however, Angela quickly comes face to face with the consequences of her assumed gender role, which culminates in her relationship with Paul, who frequently insists on having sex.

In fact, it is the scene where Angela and Paul nearly have sex that she realizes that her heterosexual, masculine identity will not allow her to adopt the role that her surrogate has laid out for her, sparking her desire to escape from the womb and be reborn as a man. The beginning of the scene is rather benign, featuring flirtatious behavior between Paul and Angela who then lie on the beach and passionately kiss. This moment is interrupted, however, by Paul's desire to touch Angela's body, which prompts a flashback of Angela and her sibling seeing her father and another man have sex. This memory upsets Angela, who forces Paul off her and runs away. It is at this moment that Angela understands her inability to fulfill the role that Aunt Martha has imposed upon her because of her homophobia. Upon first viewing, this is not as apparent because the audience still believes Angela to be a girl, suggesting that this memory has merely made her uncomfortable with men, which is why she depends so heavily on her aunt. Once

it is revealed that Angela is a man attempting to fulfill the feminine role, however, it is possible that she is associating her behavior with that of her father's, which disturbs her and, therefore, causes her to reject Paul. It might be possible that Angela rejects Paul because she is actually a heterosexual male, but because Hiltzik included this flashback during this prelude to homosexual activity between Angela and Paul, it is far more likely that Angela's discomfort in engaging with Paul stems from, what appears to be, a traumatizing memory regarding her father's homosexuality.

Understanding that she can no longer suppress her masculine identity and that her homophobia, as well as her heterosexuality, prevent her from fulfilling the role of a female, Angela begins to employ the rebirth phantasy, killing two female victims via penetration. It should be noted that both the gender of the victims as well as the method of murder is completely different from the ways in which Angela has killed the campers in the past; every victim up to this point had been male as well as killed in a way that could be construed as an accident. Angela's two female victims, both of whom are in their sexual prime, are killed in the traditional slasher style, by forcing herself into the feminine body. The first murder is rather prototypical where Angela stabs a camper with a knife while she is in the shower; the profusely bleeding wound and screaming camper clearly suggesting the process of birth. The second murder, on the other hand, is far different; Angela electrocutes the camper by shoving a hair curler into the camper's vagina, seemingly ignoring the normal pattern of slasher murders due to the lack of blood.

The two murders, however, are not meant to be viewed separately, but as one action in which the birth process is perfectly mimicked by imagery within the scenes. The first murder, as previously mentioned, contains a bleeding wound that evokes birth imagery, specifically the crowning of the child, which leads to the emergence from the womb. The murder that follows prominently features the cord that is connected to the hair curler, eliciting imagery of an umbilical cord, which is essentially a literalization of the role of the penetrating object in the slasher film. So when viewed side by side, the murders form a complete portrait of birth, where the slasher fully emerges from the female body and cuts the umbilical cord herself when she removes the curler and dumps the lifeless camper underneath a bunk bed. This suggests that Angela has finally rid herself of her dependence upon Aunt Martha, a theory that comes to fruition during the final scene, in which Angela literally sheds her female form in favor of a male body.

The film concludes with Angela having completely transformed into a fully developed man with a prominent penis, holding the severed head of Paul. Angela is covered in blood and appears to have lost the ability to talk, merely grunting at the onlookers and smiling wildly. Angela's physical transformation is largely a mystery, having grown significantly in size and developing muscles, she looks like a completely new person, which suggests the fulfillment of the rebirth phantasy. By reenacting her birth through the murder of the two female campers, Angela, quite literally, escapes the womb by shedding her feminine body, and, by extension, frees herself from Aunt Martha's influence. Even visually, Angela's naked blood soaked body aligns her with a newborn child, and because of her fully-grown adult body, it is possible that Angela has been reborn into the symbolic order, allowing her to finally act upon her masculine instincts and attain autonomy.

As is argued by Creed, Martha becomes a monster through her efforts to suppress the child's autonomy and progression into the symbolic order, but what is the viewer to make of Angela's dubious transition into the symbolic? The audience is not given much time to react to Angela's transformation, and her fate after her rebirth is left completely ambiguous. Though the film succeeds in fulfilling Creed's assertion that the maternal order is oppressive and has the potential to shatter a child's psyche, Angela's escape into the symbolic order gives the viewer little reason to celebrate outside of the escape itself. So while the perceived importance of transitioning into the symbolic order can be extrapolated from the supposed negative effects of remaining in the maternal order, the positive effects of this transition are largely unexplored.

A film that could perhaps shed some light on the role of the paternal authority in the "abandoned child as slasher film" is William Lustig's *Maniac*, which allows the viewer to witness the resolution of the rebirth phantasy and its slasher's transition into the symbolic order. The film follows Frank Zito, a serial killer who scalps and steals the clothes of women so that he can turn his mannequins into replacements for his dead mother. It is slowly revealed that Frank's mother was a prostitute who, after dying in a car crash, orphaned Frank as a young child. After murdering several women, Frank pursues another woman, Anna, but instead of killing her, he decides to date her, showing particular interest in her work as a photographer. Soon after, however, Frank once again begins to murder women, and tries to kill Anna when he brings her to see his mother's grave. Anna escapes, wounding Frank, and the film ends with Frank returning to his apartment, only to find that his mannequins have transformed into reanimated versions of his victims, who tear him limb from limb and feast upon his body.

Before examining Frank's behavior as a member of the symbolic order, it is first necessary to explore his obsession with the maternal function and feminine form, which largely defines him throughout the film. *Maniac* opens with Frank murdering a young couple, strangling the man while penetrating the woman with a straight razor, and then cuts to a screaming and sweaty Frank waking up next to one of his mannequins. Then, as the credits play across the screen and Frank moves about his apartment, the viewer is shown various aspects of Frank's apartment, which features a prominently displayed shrine dedicated to Frank's mother and posters of both the Virgin Mary as well as pinups with the nipples and genitals scratched off.

The rebirth phantasy is present immediately with Frank reconnecting with the feminine form, severing the connection, then waking up screaming like a newborn child, his sweaty form mirroring that of a child covered in placenta. Even Frank's physicality seems infantile, his bloated belly and short limbs, compounded with his near inability to speak to other humans, likens him to a child, characterizing the stage of arrested development that Frank exists in because of his obsession with his dead mother. This obsession, however, is not so much with his mother specifically, as it is with the maternal potential of the female form. This, of course, is embedded in the way that he chooses to decorate his room: with pictures of the Virgin Mary, pinup posters stripped of their genitals, and, most notably,

mannequins. Of course, the Virgin Mary perfectly embodies Frank's obsession because she is an inherently non-sexual female figure whose maternal energy pervades any piece of media she inhabits. The pinup posters, on the other hand, are objects that were originally intended to be highly provocative and sexual, and by removing the sexual components of the picture, Frank demonstrates his active disinterest in the women as sexual objects and changes them into fetishized versions of the maternal form, beautiful and inviting without any corruptive sexual agency.

But the most telling component of this obsession is Frank's treatment of his mannequins, which he uses as surrogates for his deceased mother. Throughout the film, Frank talks to the mannequins as though they are his mother, chastising her for going out the night she died, and acting as though they are "still" a happy family. Frank even justifies killing women by saying that he does it so that his mother can look pretty, suggesting a direct link between his obsession with not only his mother and the mannequins, but the murders as well. It is not too difficult to see why Frank would be so obsessed with the idea of a mannequin, an idealized representation of the human form that is completely devoid of any genitalia and cannot, therefore, be thought of as a sexual object. And by dressing the mannequins in the clothes and hair of real women, Frank makes the mannequins appear human, suggesting an attempt to bring his mother back from the dead as a sexless object whose only faculty is the maternal function.

This interpretation, however, is complicated when one considers why Frank needs multiple mannequins. After all, why would someone who is so fixated on non-sexual representations of women become tired of something that so clearly embodies his obsession? The answer lies in the murders of the women, whom he frequently confuses for his own mother. One such instance is when Frank pays a prostitute to dance for him with her clothes on, hugs her extremely tightly to his own body and kisses her, then strangles her while hallucinating that she is his mother. Though every murder in the film is rife with birth imagery, this scene is particularly telling because the viewer is given a glimpse into Frank's mind during the killing.

By revealing that Frank is actually fantasizing about, in the case of the prostitute, first fusing with his mother, which is clear through their physical proximity during their hugging, and then killing his mother, not just a representation of the maternal body, Frank's killings no longer stem from a desire to be closer to his mother but to separate from her. While this specific murder has a curious lack of blood, what is interesting about this scene is that even while Frank is strangling the prostitute, she continues to loudly scream, and as she transforms into Frank's mother, the audience's gaze moves from Frank and the victim's face to a shot of her legs and the black crotch of her outfit. Even without the blood in this particular instance, the screaming and shot of the infinite black of the prostitute's crotch still suggests a kind of birth that results from her death, keeping in line with the rebirth phantasy. Indeed, Frank's rejection of the mannequins seems to mimic this desire to separate from his mother; after rejecting the mannequin, he immediately attempts to reenact his birth and separate himself from her, and, when unsuccessful, he returns to the intrauterine state when he depends on his mannequins who are substitutes for his own mother until the urge to separate grips him once again.

The true mystery of *Maniac* arises when Frank begins to pursue Anna, a woman whom he originally intended to kill but instead becomes involved with. Following the murder of a young nurse, whom he penetrates with a sword, Frank goes to Anna's apartment completely transformed. He no longer exudes the air of a large, sweaty man-child and instead wears a freshly pressed suit, speaks eloquently, and even combs his hair. Because the scene prior to this depicted Frank successfully penetrating the female form, it is not so farfetched to suggest that he was able to master the rebirth phantasy, although, the film does little to support this claim outside of the juxtaposition of these two scenes. Regardless, it is clear that by dating Anna, Frank enters the symbolic order, which allows the viewer some insight into Frank's potential should he escape the womb. Present for only a few brief scenes, "new" Frank is a complete departure from his past self. When out to dinner with Anna, he vocalizes romantic interest in her, saying he wants to see her before her art show because, "five million other guys [will be there]." Hearing Frank acknowledge his romantic jealousy and interest in Anna is shocking when considering Frank's fixation with the female body as a non-sexual object. In fact, while Frank is in the symbolic order, his obsession with his mother disappears; during this scene, Frank talks about his mother's death in a coherent and unemotional way, clearly establishing the origins of Frank's separation anxiety and indicating that by entering the symbolic order, Frank has rid himself of the emotional scars that his mother's death imparted. By joining the symbolic order, Frank is momentarily able to rid himself of his psychotic impulses and become a normal and relatively charming human being, asserting that it was, in fact, his maternal obsession that drove him to be both murderous and repulsive.

As previously mentioned, however, this change is not permanent. After joining Anna in her apartment and meeting her friend Rita, Frank's fixation on the maternal body once again seizes him, and he murders and scalps Rita that same night. Unlike the previous shift, Frank's return to the maternal order is largely explained during Rita's murder, where, addressing her as his mother, he apologizes for hurting her and tells her that he only did so because she paid attention to so many other men. Frank then stabs Rita in the abdomen, collapses on top of her calling for his "mommy," then, with the knife still in her, removes a separate knife from his pocket and scalps her. While Frank never specifically says what he did to "hurt" his mother, it can be inferred that it was in fact his relationship with Anna, where he abandoned his mother in favor of the love of a woman, leaving the maternal order for the symbolic. By not removing the knife from "his mother's" body, Frank solidifies his place in the maternal order by refusing to sever the connection to the feminine body and obstructing the rebirth phantasy's completion.

But Frank's guilt over his relationship with Anna does not stop here; on their next date, Frank, once again dressed in shabby unwashed clothing, takes Anna to his mother's grave and attempts to sacrifice her to his dead mother, but, instead, is wounded by Anna while she escapes and calls the police. Frank, gravely wounded, hallucinates that his dead mother rises from her grave and attempts to bring him into her coffin. Scared, Frank runs out of the cemetery, and returns to his apartment where his mannequins have become reanimated versions of his victims.

The mannequins penetrate Frank with a sword and then tear him limb from limb, potentially consuming him as well. The film ends with Frank being discovered by police officers who find that Frank has indeed been impaled by a sword, but not torn to pieces.

While the film's final minutes are far more surreal that anything the viewer has encountered prior, Frank's brutalization by the maternal figures he worships shows the destructive potential of the maternal order. By having a frightened Frank almost dragged underneath the earth by his mother's zombified body, Frank's trajectory within the maternal order is literalized at the visual level; by choosing to serve his dead mother instead of the symbolic order, Frank is permanently reverted to the intrauterine, being sucked inside his mother's grave, which acts as a grim visual stand-in for the vagina. But perhaps the most interesting facet of this sequence is Frank's demise at the hands of his mannequins, who have also become zombies that rip him limb from limb. It could be said that this scene grants his victims a degree of revenge, but because the end of the scene suggests that the mannequins actually consume Frank, it is far more likely that it demonstrates Frank's assimilation into the maternal order. Indeed, since the maternal order is not satisfied solely with Frank's reverence, it must consume him so that Frank and the feminine body are truly fused once more, restoring the pre-birth power dynamics of the mother-child relationship and solidifying Frank's complete dependence upon the maternal order.

So through *Maniac* the viewer is given both the resolution and undoing of the rebirth phantasy, making it clear that slashers, such as Norman and Angela, belong in the symbolic order, but because of the monstrous maternal presence cannot fully realize their potential as individuals, therefore fulfilling Creed's concept of the monstrous feminine by way of Rank and Bowlby's assertions about abandoned children. It should be noted that this is not an exhaustive study. Films where the slasher penetrates male victims or instances when the slasher is female have been largely unexplored and require further analysis. Despite this, however, it is clear that in films where the slasher's relationship with his mother is overly reverential, his penetration of the female form is rooted in his desire to separate from the maternal order, characterizing the relationship between mother and child as monstrous and highlighting the positive nature of the symbolic order. In other words, slashing is not murder; it is just waiting to be reborn.

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Matrix Metalloproteinases as Novel Biomarkers and their Potential Therapeutic and DiagnosticApplications in Diabetic Ulcer Healing

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Chronic wounds are major burdens for patients economically and physiologically[1]. According to the National Institutes of Health, over five million people in the US suffer from chronic ulcers each year. In addition, about 27.4 million diabetic patients, both new and old, in the US developed foot ulcers in 2011[1]. The cost for treating chronic ulcers is tremendous[2]. For instance, the cost of treating diabetic foot ulcers (DFU) is about $13,000 per episode[1]. Approximately twenty billion dollars are spent on chronic ulcer therapies every year[1].

Many of the ulcers are very hard to heal when undergoing conventional treatments. It has been estimated that chronic ulcers caused by venous insufficiency affect 2.5 million patients per year in the United States[1]. In 2009, total treatment costs for diabetic foot ulcer patients with peripheral arterial disease were $32,031 per episode[1]. If about 50% of diabetic foot ulcer patients have this disease, the cost of treating 1.93 million new and old ulcers in 2010 would be as much as $61.8 billion. Furthermore, if the wounds failed to heal after 2 years, lower extremity amputation would be the only option to avoid further infection to the legs[4]. The direct cost of lower extremity amputation surgeries in the U.S. ranges from $22,700 to $51,300, depending on the positions of amputations[1].

Characteristics of Chronic wounds

Wound-healing is a complicated process. Wound-healing has three sequential processes, which are inflammation, proliferation, and re-epithelization or tissue-remodeling[4-5]. There are two types of wound, acute wound and chronic wound[5]. Acute wound-healing follows the three sequential processes[5]. Acute wounds maintain balances between degradation and production of growth factors, matrix metalloproteinase, cytokines, and other biological factors. Disruption of any steps in this complex molecular cascade can lead to chronicity[6]. Chronic wounds often have prolonged inflammation periods and elevated matrix metalloproteinase activities[6]. In addition patients with neuropathy, who cannot sense and relieve cutaneous pressure, will have longer healing periods[7]. Moreover, patients with ischemia would also have slow healing periods because reduced blood flow to the wound can undermine the supply of oxygen and other nutrients to the wound sites[7]. Other abnormalities that could extend wound-healing process include impaired neovascularization, decreased synthesis of collagen, and defective macrophage function[7-8].

Metalloproteinase Family and its Roles in Chronic Wound-Healing

Matrix metalloproteinases (MMPs) are members of the zinc-dependent endopeptidase enzyme family, which are mostly active during the inflammation stage[3]. Immune cells and reconstructive cells produce MMPs, and there are 28 MMPs in total. In addition, matrix metalloproteinases play important roles in the activation of angiogenesis during the proliferation and tissue remodeling stages[13]. Growth factors and chemokine work corporately with multiple metalloproteinases, including MMP-1, -2, -3, -7, -9, -10, and -2814. Moreover, a Chemo-gradient is created by metalloproteinase-1, -3, and -9. These MMPs are mostly active during the proliferation stage[15]. In addition, chemokine groups CXCL and CCL levels during the proliferation stage are elevated by metalloproteinases activities, a process that promotes repair of wounds[15]. Controlled production of matrix metalloproteinase is therefore critical for normal wound-healing. On the other hand, continuously elevated levels of certain metalloproteinase may cause tissue degradation and impaired wound-healing[9].

Matrix metalloproteinases are detected in human cutaneous wounds during the inflammation stage but disappear immediately after the wound is closed. MMP-2, -3 and -10, demonstrate low levels during re-epithelialization[17]. These MMPs are also involved in the inflammation stage but not in the tissue remodeling stage[17]. Researchers have suggested that overexpression of matrix metalloproteinase 10 leads to decreased concentrations of lamini-5 during the early proliferation stage[18]. This effect could seriously affect extracellular matrix cell signals and result in keratinocyte apoptosis, causing reversal of the wound-healing to the inflammatory stage, eventually resulting in chronic ulcer[18].

Tissue Inhibitor Metalloproteinases (TIMP) are the main contributor to inhibition of metalloproteinase expression. There are four TIMPs in total and they are the only natural inhibitors of matrix metalloproteinases[19]. The family of TIMPs consists of four members, TIMP-1, -2, -3, and -419.TIMP-1 is able to

inhibit the activities of all known MMPs[20]. In addition, in chronic wounds, TIMP-1 is absent or significantly lower than that in normally wounds healing process[16]. Moreover, TIMP-2 mainly acts as an effective inhibitor of pro- and active MMP-2. TIMP-3 inhibits the activity of MMP-1, -2, -3, -9, and -1321.

Metalloproteinases participate in the inflammatory stage of wound-healing through recruiting inflammation response and assisting cellular migration[8]. However, when MMPs constantly build up during inflammation stage, the wounds can become chronic and fail to reach the tissue-remodeling stage[9]. If the wounds fail to enter the proliferation stage, cell apoptosis, cancer, and other life-threatening illnesses can occur as the condition exacerbates[10,14]. Fortunately, the technology of medical biomarkers made early detections and early treatments possible[11]. If we can determine the baseline for metalloproteinase concentrations before the treatment, physicians may understand the severity and the stages of wound-healing. However, the prospects for using MMPs inhibitors therapeutically and diagnostically face many challenges[12].

Metalloproteinase as a possible biomarker for Diabetic Wound-Healing

The health burdens caused by diabetic ulcers are critical. It has been estimated that 23.6 million Americans have diabetes mellitus. Over the last five years, prevalence of diabetes, both type one and type two, increased by 30% per year[22]. The annual cost of treating Diabetic Foot Ulcers (DFU) exceeds 10 billion dollars[23-25]. The pathophysiology of diabetic foot ulcer is very complex and amputation is the only option if the diabetic ulcers are detected during the late stages[26-27].

Patients with diabetes have elevated blood glucose levels and insulin resistance[28]. When immune cells and reconstructive cells are exposed to high concentrations of glucose, disruption of the normal activities of MMP and TIMP will occur[29]. It was found that high blood glucose elevates MMP gene expression via its effects on transcriptional factors AP-1, NF-kB, PDGF, and TGF-β[30-35]. In addition, insulin resistance stimulates the expressions and the activities of MMP-9 and MMP-2[36-37]. Moreover, elevated serum MMP-9 level is associated with the progression and development of diabetic neuropathy[38]. Furthermore, previous clinical trials indicated that immediate reduction in wound areas are connected with decreased levels of MMP-9 and MMP-138. On the other hand, impairment of diabetic wound-healing was detected in type 2 diabetes patients, where the level of MMP-14 is elevated in inflamed tissue[39].

Low frequency non-contact ultrasound (LFNC-US) Therapy

The effects of ultrasound on the wound-healing process have been discussed for a long time. Recently, a new method involving the use of low frequency non-contact US (LFNC-US) treatment has been introduced as an effective healing therapy for various types of chronic wounds[40-42].

LFNC-US can accelerate the progress of wound-healing. Previous clinical trials have suggested that LFNC-US therapy can effectively increase the healing rates of diabetic ulcers among diabetic patients suffering from neuropathy and ischemia[43]. The accelerated healing process is accomplished through the induction of fibroblast cell, activation of vesicular endothelial growth factor (VEGF), and the reduction of bacterial propagation in chronic wound tissues[44-45]. This suggests that the LFCN-US therapy can activate immune response via fibroblast activity and the release of varies cytokines[46-47]. Nevertheless, we still have limited understanding regarding the molecular mechanism behind the relationship between biological effects of LFCN-US therapy and human patient clinical outcomes of the healing of diabetic ulcers.

In this study, we evaluated the relationship between dosage and duration of treatment for patients with non-healing diabetic foot ulcers (DFUs). We also searched for the possible biomarkers during diabetic wound-healing. This is the first attempt to explore the correlation between wound-healing and biological markers of tissue response (cytokines, proteinases, and growth factors) in human patients with diabetic foot ulcers. We hypothesize that MMP-9 could be a possible biomarker for the tracing and tracking of diabetic ulcers. We propose that using MMP-9 as a novel biomarker for the detection, early diagnosis, and early treatment of diabetic ulcers could be possible.

Materials and Methods:

Patients Recruitment

The study was conducted between May 2011 and July 2011. I participated in this clinical trial in Dr. Vickie R. Driver's clinic at Boston University Medical School, in the Department of Podiatry Medicine.

A total of twelve patients between the ages of 40 and 72 years old, with chronic non-healing diabetic foot ulcers were enrolled in this study. The study had obtained signed informed consent approved by the Boston University Medical Campus Institutional Review Board (BUMC IRB) in 2011. Patients were chosen based on the inclusion/exclusion criteria (Table 1) for screening. Patients were further randomized into one of the following three groups using a block randomization scheme:

Group 1: receive standard of care + LFNC-US therapy three times per week

Group 2: receive standard of care + LFNC-US therapy one time

Table 1: Inclusion and Exclusion Criteria of Patients on Screening
Inclusion Criteria
Age 18-90 years.
Diabetes mellitus, type I or II
Chronic diabetic foot wound (0.5-15 cm2 area)
Wagner grade 1 or 2
TcPO2 > 30 mmHg OR ABI > 0.6.
Ulcer size 0.5-15 cm2
Exclusion Criteria
Treatment with noncontact ultrasound during the 4 weeks prior to this study
Lower extremity malignancy (either limb)
Critical limb ischemia.
Local infection of limb with target ulcer.
Systemic infection.
Pregnancy
End stage renal disease
Severe congestive heart disease
Severe liver disease
Venous leg ulcer with or without diabetes mellitus
Known/suspected lidocaine allergy.

Table 1. Criteria for patient recruitment

Twelve eligible patients with chronic diabetic foot ulcers were selected based on the above criteria. Signed informed consent was approved by the Boston University Medical Campus Institutional Review Board (BUMC IRB).

per week

Group 3: receive standard of care only (without LFNC-US therapy)

Following screening, all enrolled patients had a one-week washout period and returned for baseline visit during week one for data and biological sample collection and treatment based on the group assigned. For sample collection, if the patients missed a visit to the clinic within two days, the patients were considered a "missed" visit. The patients were further scheduled for subsequent clinical visits.

Standard of Care (SOC)

Debridement, offloading and moist wound cares are the fundamental standard of care (SOC) procedures for diabetic foot ulcers at the Department of Surgery, Boston University Medical Center. All patients in this study received SOC procedures throughout the treatment periods.

Low Frequency Noncontact Ultrasound (LFNC-US) Therapy

LFNC-US, Celleration MIST Therapy System 5.0® (herein abbreviated as "the MIST device", Celleration, Minnesota), is a FDA approved medical device for treating chronic wounds including diabetic foot ulcers. In this study, the device was used to treat groups one and two patients. LFNC-US operates at a frequency of 40 kHz and the intensity therapeutic range delivered to the wound surface varies from 0.2 to 0.6 W/cm^2. Ultrasound (US) waves were produced in a continuous mode and a sterile saline mist was used as a medium to convey the Ultrasound. During the treatment, the device was used at a distance of 0.5 to 1.5 centimeters from the wound area and the duration of the ultrasound treatment varied according to the wound area. Average ultrasound treatment lasted approximately for 5 minutes.

Clinical Data Collection

Clinical data including patients' demographics, medical/surgical history, medication, wound characteristics such as length and width, location and grade of the ulcers, and response to the ultrasound treatment were collected at weeks 1, 2, 3, 4 and 5 using case report forms (CRF). Collected data was entered into a database system using Microsoft Access 2003.

Sample Collection

Biological samples were collected once a week during the clinical visit from week 1 to week 4. Wound fluid was collected using filter paper (PerioPaper) for 30 seconds. The diabetic ulcer tissues were obtained through tissue biopsies[48-49]. Samples were processed according to the established protocols and stored at -80 degrees C for further analysis[50-51].

Determination of Biological Markers of Healing in Wound Fluids

Wound fluid specimens from the filter strips were retrieved by high-speed centrifugation in 100 microliter phosphate buffered saline for further analysis. In order to determine the molecular level responses to treatment, several biological markers have been selected based on literature researches. These included cytokines IL-6, IL-1beta, TNF-beta, IL-8 and GM-CSF, matrix metalloproteinases-1, -2, -8, and -9, tissue inhibitormetalloproteinases-1, -2, and -3, vascular endothelial growth factor (VEGF), and transforming growth factor (TGF-beta1). These biomolecule activities were measured by multiplex xMAP immunoassay (Luminex, Austin, TX) using panels from Invitrogen (Carlsbad, CA) or Millipore (Chicago, IL) based on the manufacturers' protocols. Data was evaluated against standard curves, which were generated for each analysis and reported in unit of pg/ml.

Immunohistochemistry Analysis

Inflammatory responses at wound tissues were studied in tissue biopsies obtained during standard of care procedures. Tissues were fixed in 4% formaldehyde and kept frozen at -80 degrees C for further analysis. Five micrometer-thick sections were obtained using cryostat. Every fifth section was analyzed for the tissue morphology using the standard hematoxylene-eosin stain. Every sixth section was used for the analysis of CD68+ macrophage numbers as determinants of inflammatory infiltration. The analysis followed the protocol of the vendor (R&D Systems, Minneapolis, MN). FITC-labeled CD68-positive cells were counted using a fluorescence microscope. The data was reported as the macrophage numbers per mm^2 of wound area analyzed.

Statistical Analysis

Descriptive and analytical statistics were used to summarize the data. Categorical variables for further Chi Square tests were summarized by frequency of the ultrasound treatments and the percentage of wound reductions. Analytical statistic analysis of variance (ANOVA) were used to compare means for continuous variables and then followed with Bonferroni's correction for post-hoc analysis for multiple comparisons to see which group was significantly distinct from the rest of the groups. A Chi-square contingency test and a Fisher's exact tests were done to compare proportions for categorical variables. The correlation coefficient between two continuous variables was calculated with Correlation Analysis.

Results:

Baseline Characteristics of Enrolled Patients

Table 2 shows the baseline characteristics of patients in each group. Among these patients, two (16.7%) have type 1 diabetes and ten (83.3%) have type 2 diabetes. The average age of the patients was around 58. The average ulcer duration time was 36.44 weeks. The ankle-brachial index (ABI) was 0.91, indicating serious blood clotting in the lower extremities. Our study recruitment also demonstrated randomization because there are no significant differences (P>0.05) in the patients' demographics and ulcer features before enrollment in this study.

Clinical Wound Area Reduction after Treatment

Wound areas were measured at the screening clinical visits a week before the study, treatment visits during week 1-4 and post treatment follow-up visits at week 5. Percent area reduction (PAR) in wound size was calculated. This served as a percentage reduction to compare to baseline wound area sizes. When compared to baseline wound sizes, Group1, which received LFNC-US treatment 3 times a week, had 86% PAR between week 3 and week 5. Group 2, which received LFNC-US therapy once a week, had 25% PAR. Group 3, which received no ultrasound treatment, had about 39% PAR. Based on Figure 1, significant reductions in PAR of group 1 at weeks 3, 4 and 5 were observed

when compared to Groups 2 and 3 ($P<0.05$). There were no statistical differences between groups 2 and 3 ($P>0.05$) (Figure1). Therefore, our clinical data demonstrated that LFNC-US therapy application three times per week could have the best wound-healing speed which is 47% wound reduction over 3 weeks. On the other hand, application of LFNC-US once a week was not sufficient to achieve significant diabetic wounds area reduction.

Biomarkers of Inflammation, Proliferation and Regeneration

Inflammatory cytokines and proteinases were reduced by ultrasound therapy when comparing the changes in group1 to that of group 3 control group. In order to determine the tissue turnover profile of the levels of matrix metalloproteinase (MMP) and the tissue inhibitor matrix metalloproteinase (TIMP), we measured the levels of MMP-1, MMP-2, MMP-9 and TIMP-3. Among these metalloproteinases, matrix metalloproteinase 9 demonstrated the most significant reduction changes throughout the treatment periods in group 1, which had the ultrasound therapy three times per week. We observed a 90% activity reduction in MMP-9 levels in group 1.

Moreover, we found that VEGF was significantly related to MMP-9 levels, suggesting that the tissue repair and turnover in connective tissue metabolism was significantly correlated with angiogenesis. Diabetic ulcers healing and LFNC-US treatment had substantially improved the overall rate of tissue repair and wound-healing.

Macrophage Infiltration during Wound-Healing in Diabetic Foot Ulcers

We also obtained wound tissues through biopsies during the treatment period in order to understand cellular infiltration and inflammatory response. Figure 3 demonstrated the relationship between wound area sizes and matrix metalloproteinase-9 levels in treatment group 1, which received LFNC-US therapy three times per week. According to Figure 3, a positive linear relationship can be observed between wound area sizes and MMP-9 activity. We were able to find high levels of MMP-9 activity during the initial baseline-measuring week. On the other hand, MMP-9 activity was reduced in week 4 and week 5, accompanied by a reduction in wound area size.

A positive linear relationship between wound areas and MMP-9 level can also be found in group 2, which received one LFNC-US treatment per week, as well as the group 3 control group. However, the correlation was not as strong as that in group 1.

Conclusion:

Our results demonstrate that LFNC-US therapy is effective in treating neuropathic diabetic foot ulcers. The therapy effectively inhibited inflammation response in diabetic wounds. Treating the wounds three times per week creates the best wound reduction. Changes of profiles of biological molecules indicate that matrix metalloproteianse-9 is the candidate biomarker for diagnosing and tracking diabetic foot ulcers. MMP-9 has a positive correlation with wound size. Higher MMP-9 levels were related with larger wound area while lower MMP-9 levels were related with smaller wound area. Furthermore, the correlation between MMP-9 and VEGF suggested that the tissue repair and turnover in connective tissue metabolism is greatly associated with angiogenesis. Therefore, MMP-9 would be a promising candidate biomarker for diabetic wound diagnosis.

Discussion:

MMPs may serve as a Biomarker for Wound-Healing

Current biomarkers for diagnosing and tracking chronic wounds include alpha fetal protein, carcinoembryonic antigen, Oncotype DX, C-reactive protein, and erythrocyte sedimentation rate[52-55]. Measurements of the activities of these biomarkers can be accomplished through analyzing the wound fluids, which can prevent invasive damages to the wounds while diagnosing the statues of the wound.

On the other hand, only a few studies of biomarkers in diabetic ulcers have been conducted. The development of innovative strategies to promote tissue repair in diabetic patients is an

Table 2. Baseline Patient Charactertics of Each Group

	Group 1 LFNC-US 3x/week	Group 2 LFNC-US 1x/week	Group 3 LFNC-US 0x/week	P-value
Age	52.75 (3.77)	64.75 (8.65)	50.75 (8.47)	>0.05
Gender				
Male	100% (4/4)	25% (1/4)	75% (3/4)	>0.05
Female	0% (0/4)	75% (3/4)	25% (1/4)	>0.05
Race				
black	25% (1/4)	50% (2/4)	75% (3/4)	>0.05
wihte	75% (3/4)	25% (1/4)	25% (1/4)	>0.05
hispanic	0% (0/4)	25% (1/4)	0% (0/4)	>0.05
Diabetes type				
type1	0% (0/4)	25% (1/4)	25% (1/4)	>0.05
type2	100% (4/4)	75% (3/4)	75% (3/4)	>0.05
Diabetic year, mean (std)	16.25 (10.75)	17.75 (12.26)	19.87 (1.84)	>0.05
Retinopathy	25% (1/4)	75% (3/4)	0% (0/4)	>0.05
Nephropathy	25% (1/4)	0% (0/4)	25% (1/4)	>0.05
Neuropathy	100% (4/4)	100% (4/4)	100% (4/4)	>0.05
History of amputation				
major	25% (1/4)	25% (1/4)	25% (1/4)	>0.05
minor	0% (0/4)	50% (2/4)	50% (2/4)	>0.05
Ankle-brachial index	0.98 (0.38)	0.89 (0.19)	0.85 (0.23)	>0.05
Ulcer location				
plantar	100% (4/4)	50% (2/4)	100% (4/4)	>0.05
dorsal	0% (0/4)	25% (1/4)	0% (0/4)	>0.05
medial	0% (0/4)	25% (1/4)	0% (0/4)	>0.05
Wagner grade				
grade I	75% (3/4)	75% (3/4)	25% (1/4)	>0.05
grade II	25% (1/4)	75% (3/4)	75% (3/4)	>0.05
previous wound infection	0% (0/4)	0% (0/4)	0% (0/4)	>0.05
Ulcer duration, week, mean(std)	16.00 (11.53)	29.33 (19.73)	64.00 (65.07)	>0.05

Table 2. Baseline patient characteristics of each group:

Baseline characteristics of subjects in each group are recorded at baseline. All patients were able to come to the clinic for follow up studies over the study.

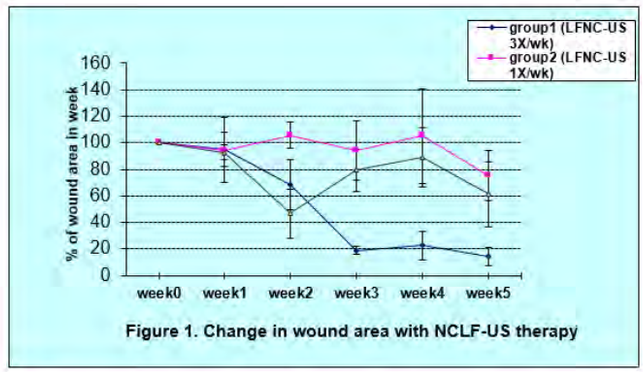

Figure 1. Change in wound area with NCLF-US therapy

Figure 1. Change of wound size with the LFNC-US therapy

Twelve (12) eligible patients with chronic diabetic foot ulcers were randomized into one of three groups. Celleration MIST Therapy System 5.0® was used for the treatment of chronic wounds. Wound sizes were calculated by length x width and expressed as percent change from the baseline wound size at week 1.

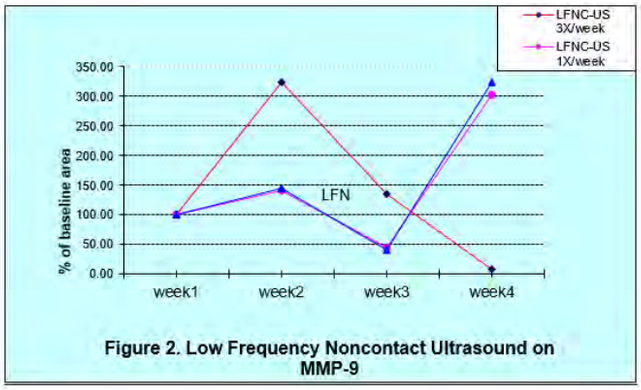

Figure 2. Low Frequency Noncontact Ultrasound on MMP-9

Figure 2. Change of cytokines and matrix metalloproteinases (MMP)-9 in wound fluid with the LEFU-US therapy.

Wound fluids were collected during the study visit. Biological marker, MMP-9, was quantified using Luminex 100 multiplex assays. Results were also expressed as the percent change compared to baseline levels of these markers.

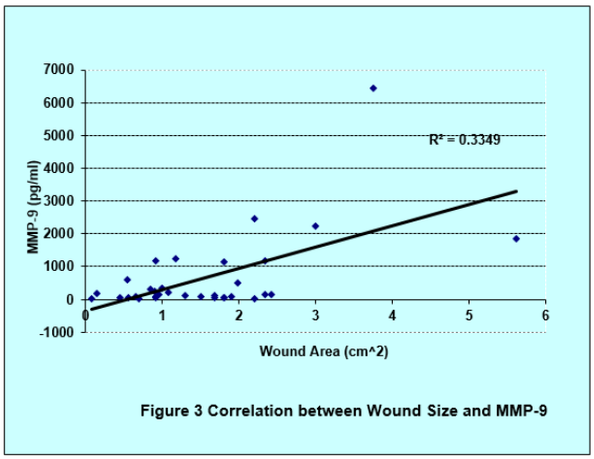

Figure 3 Correlation between Wound Size and MMP-9

Figure 3. Correlation analysis of MMP and wound size

Wound fluids were collected during the study visit. A correlation regression analysis was performed to test the relationship between the MMP level in serum and the wound size area. A positive linear relationship was found between the size of the wound and the level of MMP9.

important task that requires a more thorough analysis of the underlying molecular pathophysiology. Currently, 149 specific protein profiles have been identified that were significantly active during persistent inflammatory responses[56]. Particularly, specific wound areas can be identified through gene expression profiling[57]. Identification of these molecular markers will help guide surgical debridement to make it more efficient.

Point-of-Care Treatment using Matrix Metalloproteinases as Biomarkers

Among the aforementioned potential biomarkers, matrix metalloproteinases received the most attention[58]. An expert panel including Dr. Driver has concluded that diabetic wound care lacks specific diagnostic tests. They agreed that appropriate matrix metalloproteinases activities were important in wound-healing. On the other hand, measurement of only an individual metalloproteinase would not be representative of the environment of the wound. Wider selections of other biomarkers might be useful in directing wound care, especially in outpatient settings[58].

The general way to conduct point-of-care (POC) tests using metalloproteinases as biomarkers is to assess the metalloproteinases reading at the time when the wound occurs. The reading should be set up as a baseline for further measurements. It is during the next few months that physicians can diagnosis the wound as chronic. In addition, physicians would like to determine if metalloproteinases' or other biomolecules' activities are elevated over a certain period of time, because confounding factors may interfere with the parts of a protease test, such as the timing, cleansing, and debridement[59].

Based on current findings, a point of care test could be conducted four weeks after the initial visit and at two-week intervals afterwards. The two-week intervals could allow the effects of the ultrasound therapy to elapse before retesting. This 2-week period also allowed matrix metalloproteinases activities to dissipate. In this way, physicians can avoid the mistakes caused by blind prescribing. The POC tests can show when a wound is stuck in the inflammation stage during wound-healing through testing the activities of MMPs. This information could allow doctors to prescribe the right amounts of inhibitory agents. Such strategy could also save resources and energy of the healthcare facilities and benefit patients economically[59].

Implications of Targeting Metalloproteinase in Clinical Trials

Matrix metalloproteinase activities are detected in the bone regeneration process. Significant elevated levels of MMP-2 and MMP-9 are detected in sub acromial fluid of 23 bone-fractured patients upon their arrival at the hospital[60]. This suggests that the measurement of bone healing specific MMPs (MMP-2 and MMP-9) can be useful when monitored in parallel with measurement of growth factors to evaluate bone remodeling and tissue healing.

Moreover, metalloproteinases activities are also high in tumor cells growth and metastasis. The activities are led by abnormal angiogenesis expression. Developing clinically useful antagonists of matrix metalloproteinase is crucial[60]. Metalloproteinase inhibitors have been or are currently being tested in clinical trials against a variety of human diseases, many of which are cancer related[61-62].

In addition, novel approaches to inhibit of metalloproteinases activities are recently being tested in chronic wound care. It was shown that doxycycline can inhibit MMP activities[63]. In a pilot study, addition of doxycycline into the fluids collected from the diabetic foot ulcers patients can sufficiently reduce matrix metalloproteinaseactivities[63]. When applying doxycycline to the chronic wound site, the chronic ulcers were healed within 30 weeks. Another mechanism by which doxycycline may facilitate the healing of ulcers is through indirect inhibition of serine proteases[64]. When topically applied to diabetic ulcers, doxycycline lowered the levels of serine proteases[64]. Research showed a negative dose-response relationship between doxycycline and

MMP-2 levels among patients with chronic severe periodontitis. Patients treated with this form of doxycycline had reduced depth of surgically treated sites and accelerated rates of wound-healing, suggesting that the doxycycline can improve the rate of wound-healing[65].

Furthermore, excessive metalloproteinases activities in chronic wound fluid can be inhibited by bisphosphonate alendronate, when combined with poly (2-hydroxy methacrylate) hydrogel[66]. Directly applying the hydrogel and bisphosphonate alendronate to cutaneous wounds improved wound-healing results. This therapy allowed MMP-9 to remain active in the upper cellular layers of the ulcers[66].

Our current study indicated that metalloproteinase-9 may be the candidate biomarkers associated with wound-healing status: metalloproteinase-9 has direct relation and positive correlation with wound size ($P<0.05$). Higher MMP-9 level is associated with larger wound area while lower MMP-9 with smaller wound area. Our findings also indicated a significant correlation between MMP-9 and VEGF. Moreover, this correlation between MMP-9 and VEGF suggests that the tissue repair and turnover in connective tissue metabolism is significantly associated with angiogenesis.

Therapeutic Values of Low Frequency Non-Contact Ultrasound (LFNC-US)

The growing incidence of non-healing diabetic ulcers requires clinicians and researchers to test and introduce novel and effective therapeutic strategies. In recent years, the potential therapeutic applications of low frequency non-contact ultrasound (LFNC-US) to wound care have been supported by several clinical studies, indicating that this ultrasound therapy may be useful in accelerating the diabetic wound-healing process[67-69].

Previous studies in 2010 performed by Dr. Driver's research team summarized the effects of a noncontact low-frequency ultrasound (NLFU) therapy on chronic wounds healing[70]. In this clinical trial, the ultrasound therapy was associated with 85.2% chronic wound area reduction over a 7-week period. In our study group 1, which received the ultrasound therapy 3 times a week, had about 86% wound area reduction. Group 2, which received the ultrasound therapy one time per week, had about 25% wound area reduction. Group 3, which did not receive the ultrasound therapy, had 39% wound area reduction. Previous studies suggested that 50% wound area reduction under 4 weeks should be a good indication that the chronic wounds will heal fast. Patients with neuropathy showing a 50% wound area reduction in 12 weeks would also indicate a good healing process[71-73]. Our results showed that application of LFNC-US three times per week for four continuous weeks accelerates diabetic wound-healing process. We concluded that a therapeutic application of LFNC-US three times per week creates the best wound reduction. This can be considered as a standard dosage for ultrasound therapy in diabetic foot ulcer patients in the future.

Wound-healing is accomplished through the stages of inflammation, proliferation and tissue-remodeling[5]. A prolonged inflammatory phase, accompanied with excessive inflammatory cytokines and metalloproteinases, are two of the biological characteristics of chronic wounds[74]. Chronic wounds of diabetic patients contained abnormally high levels of proteases and metalloproteinases, which prevent the normal wound-healing process[75-76]. Our work demonstrates that inflammatory cytokines, along with MMP-9 levels, are decreased over a 4 week period of the ultrasound therapy, indicating possible mechanisms of ultrasound on wound-healing.

In conclusion, low frequency non-contact ultrasound (LFNC-US) is very effective in treating neuropathic diabetic foot patients by inhibiting inflammation in chronic wounds. Therapeutic application three times per week creates the best wound reduction benefit. Most importantly, metalloproteinase-9 is the best candidate biomarker for detecting and treating diabetic ulcers.

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