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A decision support system for scheduling carers in domiciliary care settings: What are the key factors, weightings, and constraints?

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A dissertation submitted to the University of Dublin in partial fulfillment of the requirements for the degree of Master of Science in Health Informatics

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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university.

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Dedication

I would like to dedicate this dissertation to my loving family for their unprecedented support.

Acknowledgment

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Abstract

The purpose of this research was to identify the key factors, including the weightings and constraints associated with those factors that play a vital role when scheduling of carers in domiciliary care settings. A scoring model was designed and developed to evaluate the results. The aim of the study was to:

- *Identify the key factors, weightings, and constraints*
- *Design a scoring model based on the decision matrix algorithm*
- *Evaluate the scoring model output by implementing it in a computer-based program*

The researcher used a mixture of both qualitative and quantitative research methods for this study. A literature review was performed to identify the key factors, weightings, and constraints. To gain an Irish perspective, semi-structured interviews were scheduled with 14 participants from five different domiciliary care providers, two clients in receipt of domiciliary care and one HSE commissioner of Home Care Package (HCP) funding. The outcome was analysed and discussed to establish a final scorecard that was used as a basis for the scoring model. A scoring model decision support system was designed and implemented in a computer program to evaluate the model.

The study established that, there are 22 key factors that should be considered when scheduling the carers for domiciliary care. The weighting of each of these factors was also identified. The study also established that there are three hard constraints that need to be satisfied before scheduling a carer. During the design of the scoring model, the original 22 factors amalgamated into 20 factors. Implementation of the program was carried out in MS Visual Basic Application scripting and MS Access. For the evaluation five carers, five clients, and 40 tasks were added in the database. Evaluation of the scoring model established that the system was automatically allocating the best-suited carer based on the client and carer preferences and the key factors, weightings and constraints.

Keywords: *Domiciliary Care, Carer Scheduling, Key Factors, Weightings, Constraints, Scoring Model*

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Abbreviations

ROI	*The Republic of Ireland*
HSE	*Health Service Executive*
HCP	*Home care package*
HIQA	*Health quality & safety commission*
VRP	*Vehicle routing problem*
CSV	*Comma-separated values*
ICT	*Information and communication technologies*
HL7	*Health Level-7*
U.S.	*The United States of America*
PK	*Primary key*
WTG.	*Weighting*
USB	*Universal Serial Bus*
SLA	*Service-level agreement*
GIS	*Geographic information system*

Glossary

Client	*Patient/person receiving care*
Care Manager	*Homecare manager who manages and schedules carers*
Carer	*Person who visits a client's home and provides care*
Domiciliary care	*A domiciliary care is care provided to people living in the community in their own homes*
Care Plan	*A plan that will set out the agreed care outcomes and actions to be undertaken by all services, supports, and care staff to attain these outcomes*
Reablement	*A short and intensive service, usually delivered in the home, which is offered to people with disabilities and those who are frail or recovering from an illness or injury.*
Weighting	*Allowance or adjustment made to take account of special circumstances or compensate for a distorting factor.*
Hard Constraints	*Factors that must be satisfied all the time*
Source code	*In computing, source code is any collection of computer instructions written using some human-readable computer language, usually as text.*

Chapter 1

Introduction and Background

1.1. Introduction

According to the UK Department of Health (Care Standards ACT 2000), domiciliary care is care provided to people living in their own homes in the community. These people may have a physical disability, sensory loss or mental health issues. They wish to live alone in their own home and maintain a level of independence but they need assistance with their personal needs, and therefore receive care at home (Barry, 2010). Government and local (health) authorities also encourage people to stay at home and receive assistance required according to their needs, this reduces the overall work load on hospitals. Preferably care is provided by a family member (family carer) but in many cases family members, but in many cases family members may not be available to act as carers. In such cases care can be provided by a formal carer. According to the Family Carer Alliance (FCA), a carer is a person who provides care to another individual who needs assistance in his/her day-to-day living activities. The carer may or may not be paid, and the person needing assistance may or may not be a family member. Example include, a husband who needs assistance after suffering a stroke or a wife who needs assistance due to Parkinson's disease, or a mother-in-law with cancer, a grandfather with Alzheimer's disease or a son with a traumatic brain injury from a car accident. Informal carer or family carer are terms used for carers who are unpaid, such as family and friends. These carers can be primary or secondary carers; they can be living with the person who requires care, or they may be living separately. Carer hours can be flexible and carers may also be part time or full-time. Formal carers are individuals providing care as the employee of of a voluntary or private organisation (FCA, 2012). In Ireland, care provided by these organisations can be partially funded by the HSE, if clients meet stated eligibility criteria (HSE, 2014).

1.2. Background

According to the 'National Council on Ageing and Older People', in long-term care *'Quality of care is a key determinant of quality of life*' (NESF, 2005). There is rising demand for long-term care due to aging demographics this requires extra carers. Providing optimised carer schedules while maintaing the quality of service is essential. A report by Centre for Ageing Research and Development in Ireland (CARDI) (CARDI, 2012) shows a rise in both ageing population and demand for care in Northern Ireland and the Republic of Ireland (Wren et al., 2012) (CARDI, 2012). Figure 1.1 shows the key findings of the report:

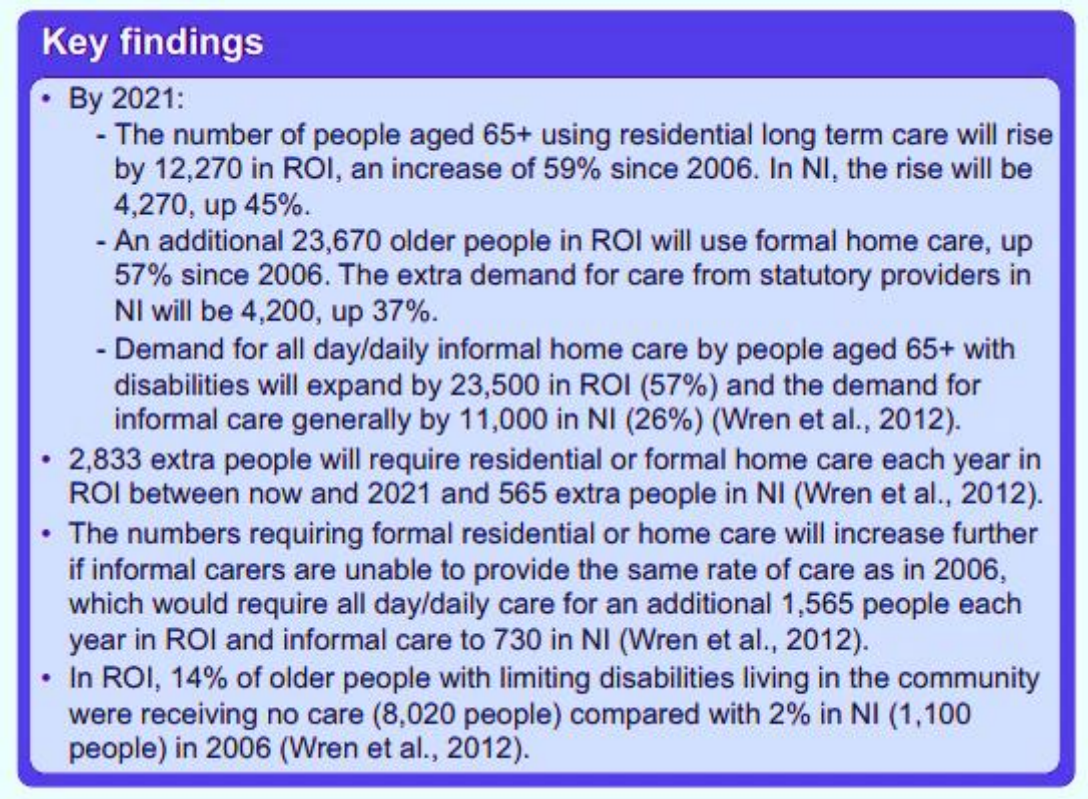

Figure 1.1. Demand for long-term care (*CARDI, 2012*)

As discussed above, there is a rise in domiciliary care demand. Therefore, it is essential that scheduling of carers be performed carefully and intelligently by matching the right carer to suitable clients to provide quality care. Another factor to note concerning scheduling domiciliary care staff is that scheduling is a combination of two problems: a staff scheduling problem (Ernst et al., 2004) and a vehicle routeing problem (VRP) (Cordeau et al., 2001). The staff rostering aspect, in particular, has many things in common with the nurse rostering and scheduling problem (Burk et al., 2003) (Cheang et al., 2004) regarding skill category,

shift type, and time-related constraints. However, the home care scheduling problem has a further requirement of a routeing task from client to client (Yuan et al., 2015).

1.3. Domiciliary Care Settings in Ireland

In Ireland Domiciliary care is provided by various types of home care agencies including private and voluntary organisations**.** The government also supports domiciliary care services for clients who are eligible based on the criteria created by the HSE (Health Service Executive). Funding provided by the HSE is categorised into '*Generic Services and Funded Services*' (NESDO, 2009) (HSE, 2014). The purpose of the HCP scheme is to encourage the proper release of elderly individuals from hospital to enable these individuals to live independently at home. Furthermore, the scheme aims to reduce the load on Emergency Departments (ED); to support older individuals to keep on living independently, to allow individuals to live in their home for longer; and to support carers (HSE, 2010).

In brief, an initial assessment of client is performed by HSE. Based on the results of this evaluation, a care plan is then developed which is approved by healthcare professionals and then forwarded to the domiciliary providers. Care providers will then review the care plan and their carer staff capacity, based on which a suitable carer is scheduled (HSE, 2010).

Figure 1.2 shows the Home Care Package (HCP) operational process:

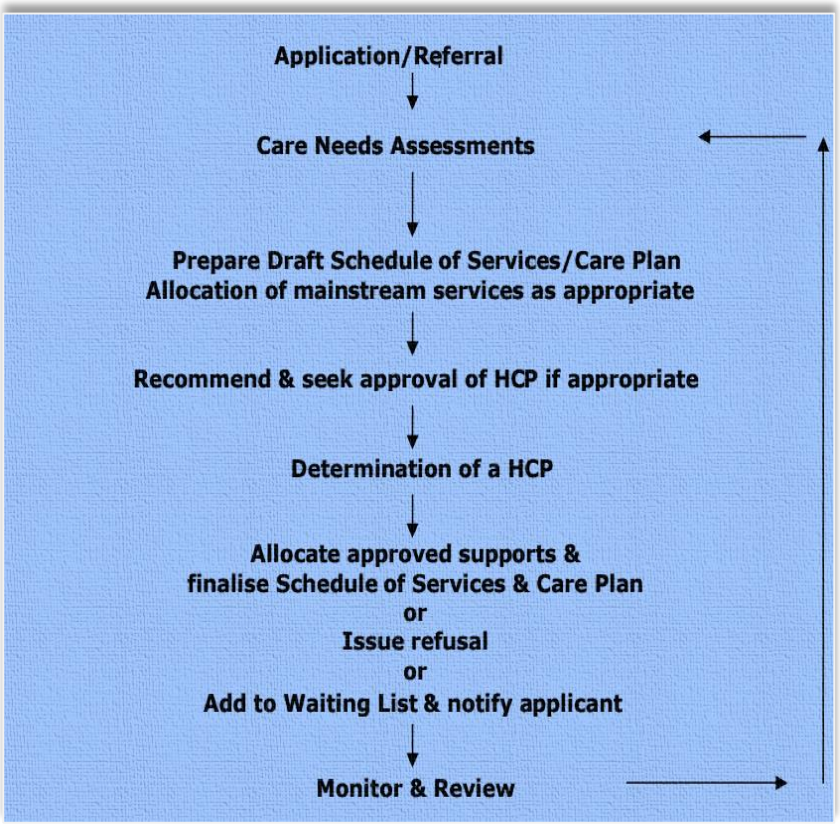

Figure 1.2. HCP operational process (*HSE, 2010*)

1.4. Scheduling Process

Carer scheduling in a domiciliary care setting can be a very complex process because it is a combination of both rostering and routeing problems, as discussed above. Once carers are hired, they are trained, and their availability is determined. Some carers may also have preferences such as the locality where they would like to work, based on their mobility or otherwise. Similarly, when a client needs service, a needs assessment is performed. A care plan is then devised along with preferences. During the scheduling process, carer preferences are cross-checked with the client's needs and preferences and a suitable carer is identified as indicated in Figure 1.3 on the next page:

Figure 1.3. Scheduling process in domiciliary care

1.5. Motivation

This research was motivated by the fact that the researcher is currently working in the information and communication technologies (ICT) industry and deals with software for healthcare providers. While historically there has been much focus on doctors and nurses rostering software for hospitals, not much work has been done on scheduling within domiciliary care settings. It is important to note that the nature of home care differs from that of nursing as well. It is more complicated from a scheduling point of view as it is a combination of nurse rostering and vehicle routeing problems (Ernst et al., 2004) (Cordeau et al., 2001).

The importance of this research is accentuated by the fact that in most cases, people would prefer to live in their homes and to have support services provided in a way that would allow them to remain in their homes or communities for as long as possible and support an active and healthy lifestyle as discussed in detail in the research background.

The provision of higher levels of care and support for older persons, particularly the growing number of those living alone, becomes more necessary as dependency increases with age. This means that community care encompassing personal care services, nursing and certain medical services, as well as housing and transport services required to be provided in a manner that meets these needs through a combination of self-care and support for formal and informal carers in the family and at community level, as well as developing a parallel system of residential care (Barry 2010).

Therefore, providing quality domiciliary care is an important requirement. Quality care can be given by sending the most appropriate carer to a client. This leads to the question of how to identify the best or most suitable carer, which inspired the researcher to carry out research on how quality can be improved by matching clients and carers through the identification of key factors that influence matching decisions and to incorporate any weightings or contraitns associated with these factors.

1.6. Research Question

"*A decision support system for scheduling carers in domiciliary care settings: What are the key factors, weightings, and constraints?*"

1.7. Research Objectives

The main aims of this research are to identify the key factors for carer scheduling in domiciliary care settings. What are the constraints? Is there any weighting associated with these factors? Can a scorecard and scoring model be developed to suggest the best way to identify the most suitable carer?

This research will also explore different scheduling algorithms, and design and develop a scoring model that will help in scheduling carers. The following are the objectives of this study:

- Identify the key factors
- Determine the weighting of each factor
- Identify the constraints
- Design a decision support, scorecard and scoring model system
- Implement the scoring model decision support system and evaluate results

1.8. Conclusion

This chapter concludes the background of the research. Demand for domiciliary care is increasing as the population ages. At the same time, there is a need for economical quality care. Domiciliary care is a very complex domain. Scheduling homecare staff is very challenging due to the combination of problems such as the vehicle routeing problem and nurse rostering problem. However, demand can be met by sending the right or best-matched carer. Recognising this, the researcher was motivated to research the key factors and challenges associated with identifying and scheduling the right carers. The research question and research objectives have been defined and established in this chapter. This research will primarily focus on the technical aspects of the key factors for scheduling carers, the weighting of these factors and how these factors can be used to improve the quality of care as its objective.

1.9. Synopsis

This dissertation is organised into the following chapters:

Chapter 1: **Introduction and Background**

In this chapter, the context of the research is established. Motivation, research question, and objectives are defined.

Chapter 2: **Literature Review**

In this chapter the literature review is performed, to identify the key factors, weightings and constraints.

Chapter 3: **Research Approach**

In this chapter methodology of the research is explained. What research methods will be used and how research will be carried out.

Chapter 4: **Scoring Model Analysis**

In this chapter key factors, weightings and constraints analysis will be performed based on the interviews outcome.

Chapter 5: **System Model Discussion & Design**

In this chapter literature review and interview analysis will be discussed to finalise the key factors, constraints, and weighting. A scorecard and scoring model system will be designed and developed.

Chapter 6: **System Implementation**

In this chapter, a decision support scoring model system will be implemented and evaluated.

Chapter 7: **Results and Conclusion**

In this chapter, research results, any limitations and future recommendations will be discussed.

Chapter 2

Literature Review

2.1. Introduction

According to the literature review, in the U.S. over 52 million informal and family carers provide care to someone over the age of 20 years who is ill or disabled (Health and Human Service, 1998).

- A further 29.2 million family carers provide personal assistance to adults (over the age of 18 years) with a disability or chronic illness (Arno, 2002), while 34 million adults (16% of the population) provide care to adults over the age of 50 years (National Alliance for Caregiving, 2004).

- 8.9 million carers (20% of adult carers) care for someone over the age of 50 years who have dementia (Alzheimer's Association and Bethesda: National Alliance for Caregiving, 2004).

- Furthermore, between 78 and 87 million people (family, friends, and neighbours) provide care to individuals over the age of 65 years who need assistance with everyday activities (National Long-Term Care Survey, 1989 & 1994).

- Unpaid family carers will likely continue to be the largest source of long-term care services in the U.S. and are estimated to reach 37 million carers by 2050, an increase of 85% from 2000 (Health and Human Services and Assistant Secretary for Planning and Evaluation, 2003).

To deal with such a magnitude of care needs, care coordination must play a vital role. Care coordination is a critical element in caregiving as stated by The Health and Human Services and Assistant Secretary for Planning and Evaluation (2003). The future demand for long-term specialised domiciliary care is increasing with the passage of time. A report to Congress in Washington, DC (2003) states that care provider organisations should provide a best-fit carer to meet every client's long-term wellbeing, security and prosperity requirements, and furthermore should offer a broad list of qualified carer workers with differences in background, encounters, and identities to guarantee a quality care that can be altered to meet individual client requirements and inclinations.

To provide quality care, the identification of the main factors which play a key part in scheduling is crucial. As indicated by Woerner in his book '*Scheduling Home Health Care Personnel*', factors include time, service needed, availability of the client, personal preferences for service, availability of outside support, and psychosocial needs of the client. Personal factors such as services needs, geography, and availability of appropriate carers should also be considered. In addition to the foregoing factors, personal qualities, such as maturity, motivation, commitment, interpersonal skills and manners, flexibility, preferences, professional goals, honesty, time management, employee preferences and special factors also matter when scheduling carers (Woerner, 1988).

It is imperative that carers be intelligently scheduled. For example, when dementia advances, the capacity of an individual with dementia will change. A good carer with imagination, adaptability, and critical thinking will have the ability to adjust his or her day to day routine to deal with this progression in a client (Alzheimer's Association, 2016). According to the Alzheimer Association, it is imperative that a carer arranges the client's day. A man with dementia will, in the long run, require a carer's help to arrange his day. Arranging exercises for people with dementia works best when these are properly thought out and organised, as necessary exercises can regularly boost one's state of mind. Before making an arrangement, consider, for example, the client's preferences, dislikes, qualities, capacity and interests. How is the individual's day structured? What times of day best suit the individual for certain tasks? Ensure ample time for supper, washing and dressing. Establish regular times for waking and going to bed (this is particularly significant if the individual with dementia encounters rest issues). It is also important that carers and care providers take into account adaptability inside a client's everyday routine for unconstrained exercises (Alzheimer's Association, 2016).

While this research is mainly focused on the quality of care from the client's perspective, another interesting factor identified is the carer's quality of life, which will eventually affect the care quality. A study by Morimoto was undertaken where 100 community-based nurse carers were recruited from seven randomly selected neurological hospitals with outpatient rehabilitation clinics in western Japan and interviewed using the Zarit Burden Interview (Lai et al., 2007) (Zarit et al., 1980), the Modified Barthel Index, the Geriatric Depression Scale and the SF-12 Health Survey for health-related quality of life. Results showed that increased carer burden was significantly related to worsening health-related quality of life, particularly worsening mental health (Geriatric Depression Scale and SF-12 items), even after controlling for carer age, sex, chronic illness, average caregiving hours/day, and functional dependence of the client. Also, the prevalence of depressive symptoms among carers was twice that of community-dwelling older people. Roughly 52% of carers had Geriatric Depression Scale scores that warranted further evaluation. However, despite the prevalence of depressive symptoms, only one carer had received any psychiatric care during their caregiving tenure (Tomoko et.al, 2002) (Hérbert et al., 2000).

As shown in Figure 2.1, according to the Home Care Pulse, there are numerous elements to consider with regard to coordinating a client with an appropriate carer. Clients' needs and preferences are assessed, and qualified carers are matched and scheduled based on client requirements to provide the best care. Various factors need to be considered before matching the right carer (Home Care Pulse, 2014). Similar recommendations were provided by Woerner (Woerner, 1988), as shown in Figure 2.1:

Figure 2.1. Key factors influencing client and carer match (*Home Care Pulse, 2014*)

2.2. Literature Review of Key Factors

Based on the literature review, the following themes emerged:

- Personal Factors
- Geographic Factors
- Professional Factors
- Cultural Factors

Figure 2.2. Themes identified for the key factors

2.2.1. Personal Factors

Gender was a major factor identified during the literature review. According to Hansen, a gender preference is one of the central points in identifying suitable carers. Consistent with past research, the level of understanding in a clinical circumstance was observed to support same gender preferences. Female patients feel more comfortable with female medical attendants (Hansen, 2002).

Reviewing the literature further demonstrates that gender preferences also exist in other different but related fields where the staff is required to care for clients. For example, a study

carried out on flight passengers showed that passengers were more comfortable with young female flight attendants. A portion of travellers also indicated that language was another factor that enhanced the service as passengers could easily communicate their needs. This study helped the airline to improve their consumer loyalty using these factors (Foster, 1989).

Gender preferences must be taken into account when scheduling a carer, as a male client might feel uncomfortable with a female carer and similarly a female client may feel uncomfortable with a male carer. This could lead to a client refusing to receive service. Therefore, it is imperative that, when scheduling, client preferences such as gender, age, and ethnicity are all considered in care coordination circumstances. When these conditions are met, the client receives quality service (Home Care Pulse, 2014). According to Coon, in the same way that there are male and female gender preferences, there are preferences for other groups such as lesbian, gay, bisexual and transgender (LGBT), these lead to new challenges that the carer has to face (Coon, 2004).

Studies also show that more women than men are carers. An estimated 59% to 75% of carers are female (KFF, 2002). Research suggests that the number of male carers might be expanding and will keep on doing so because of an assortment of social demographic components (Kramer et al., 2002). One report records a 50% increase in men becoming primary carers between 1984 and 1994 (Spillman, 2000). However, while more men might be undertaking full-time caregiving than previously, female carers still perform the majority of domiciliary care. Figure 2.3 shows that statistically there are more female carers than men in the U.S. (United States of America).

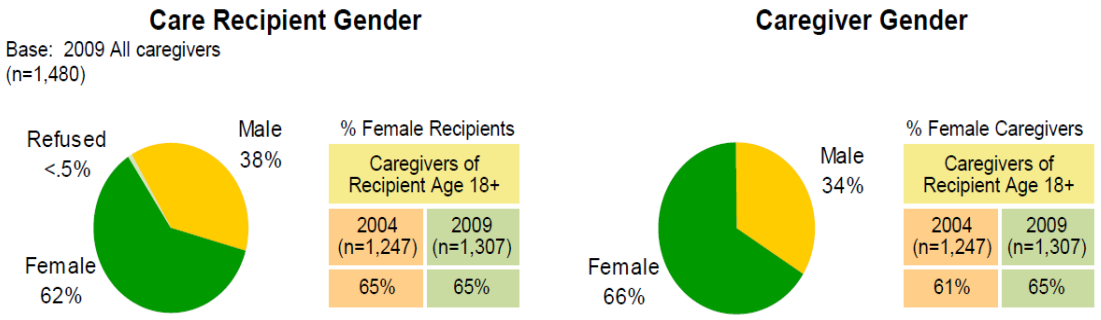

Figure 2.3. Carer vs. client gender comparison
(*NAC & AARP, 2009*)

While some studies demonstrate a fair dissemination of caregiving amongst men and women, female carers invest twice as much energy giving care as male carers (Health and Human Service, 1998). However, among carers over the age of 75, both genders provide equal measures of care (McCann et al., 2000). Other studies have found that women carers handle the most troublesome caregiving assignments (i.e. washing, toileting and dressing) when contrasted to their male partners who are more likely to help with accounts, managing care and different, less hands-on undertakings (Metlife Mature Market Institute, 2003). A number of studies have found that female carers are more likely than men to experience the ill effects of tension, melancholy, and different indications connected with personal anxiety because of caregiving.

Profiles of carers supporting elder clients demonstrate that the majority of these carers are women, either mothers or daughters or daughters-in-law. Most of the studies have indicated that women make up more of the numbers when it comes to domiciliary care support. Findings also conclude that men and women have different approaches to dealing with people with different illnesses (Pinquart et al., 2006). A carer review technique created by Guberman gives a Canadian case study for situations like this, to measure the dimensions involved in carer stress levels (Guberman et al., 2001).

The literature review also found that various individuals would prefer to receive domiciliary care from somebody of the same age. Research shows that younger females usually preferred to receive care from younger care professionals as compared to aged carers (Hansen, 2002). Intervention research has established that the age of the carer is an element that can have an impact on whether certain sorts of intercession will be powerful or not. Desires and fears of elder carers are different to those of younger carers. Elder carers can have more sympathy toward a client who may be suffering from a health condition similar to one the carer has (Hancock et al., 2007).

Figure 2.4 shows the hours of care provided according to the age of carer:

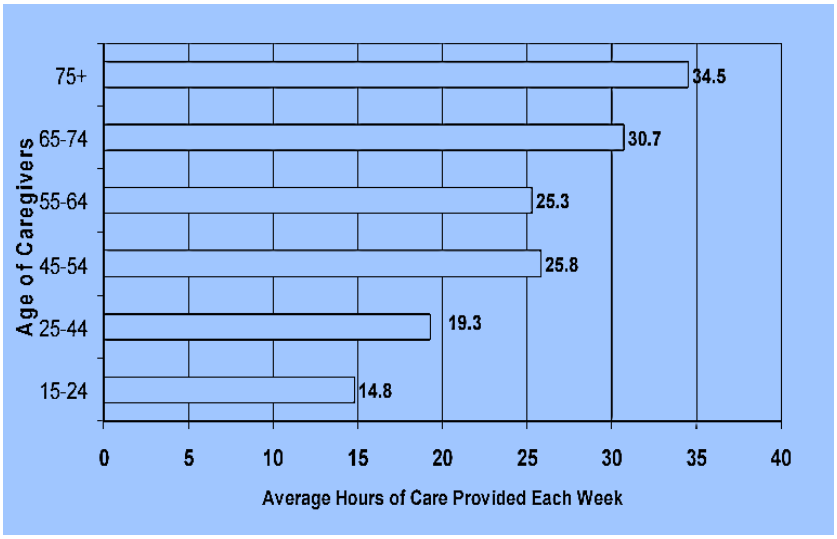

Figure 2.4. Age of carer vs. hours provide

(*Alecxih, 2001*)

- Carers can belong to any age group; however, the majority of carers are moderately aged from 35 to 64 years old (Alecxih, 2001).
- The usual age of a carer looking after a client over 20 years is estimated to be 43 years old (Health and Human Services, 1998).
- In relation to those caring for someone over the age of 50 years, the average age of a family carer is 47 years (NAC & AARP, 2004).
- In many cases carers looking after the elderly are themselves elderly. For older clients over the age of 65 years, the standard age of carers is 63 years; 33% of these carers are not in good health (Administration on Aging, NFCSP Complete Resource Guide, 2004).
- Similarly, it has been found that the quantity of hours devoted to caregiving increases with the age of the carer (Baltimore Johns Hopkins University, 2002).

Figure 2.5 shows U.S. based data on carer age-groups and the percentage of carers in each age-group:

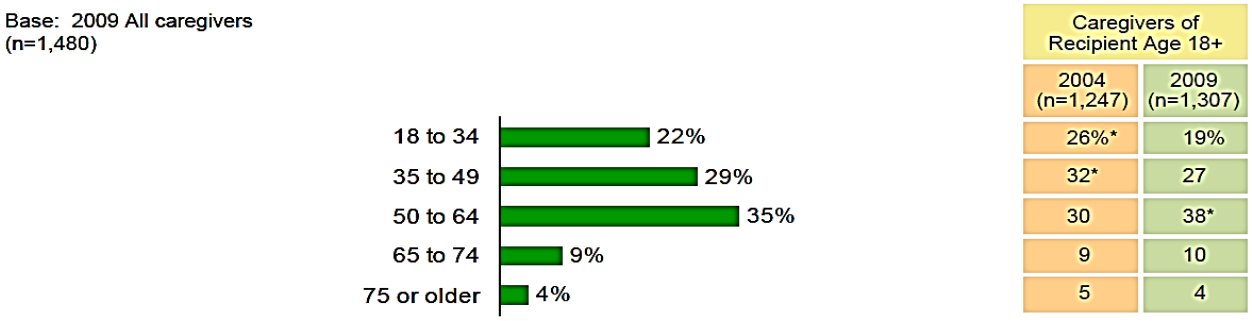

Figure 2.5. Age groups of carer (*NAC & AARP, 2009*)

Table 2.1 shows U.S. based data for age groups of care recipients as compared to age groups of carers:

Table 2.1. Age of predominant care recipient by age of care (*NAC & AARP, 2009*)

	Caregiver Age		
	18 to 49 (n=560)	50 to 64 (n=616)	65 or older (n=285)
Average Recipient Age	*52.8*	*69.4*	*69.5*
Recipient 0 to 17 years	21%	7%	6%
Recipient 18 to 49 years	15	12	13
Recipient 50 to 74 years	35	17	29
Recipient 75+	29	63	53

The literature review indicated that smoking is another major factor regarding scheduling domiciliary care professionals in community care. Clients who do not smoke prefer non-smoking carers (Home Care Pulse, 2014). According to O'Sullivan in "Health and Well-being of Family Carers in Ireland: results of a survey of recipients of the Carer's Allowance" there is a high percentage of smoking amongst carers when compared with the general population and because of this, the responses were compared with the 'Survey on Lifestyle and Attitudes to Nutrition' (SLÁN) survey in 2002, based on a national population. In order to ensure an accurate comparison, the data from the SLÁN survey was weighted for various factors including age, gender and educational attainment. The survey found that about one-quarter (26%) reported smoking habitually and 5% reported smoking infrequently. A

comparison with the SLAN survey indicates that carers are more prone to picking up the habit of smoking as compared with the rest of the general population (O'Sullivan, 2008).

Table 2.2. Percentage of smoking carers (*O'Sullivan, 2008*)

Smoking cigarettes/cigars now	Carers Per cent of carers	SLÁN (weighted) Per cent of adult population
Smoke regularly	25.9	21.0
Smoke occasionally	4.8	3.3
Do not smoke	69.3	75.7
Total	100.0	100.0

Hobbies and habits are another two factors that can be advantageous when matching client and carer for quality care. As indicated by Home Instead, a large care provider in Ireland, one of the most critical aspects of assigning a carer with Home Instead is promoting companionship and discussion. Each carer is coordinated with a client regarding shared interests and leisure activities to drive the creation of a solid relationship (Home Instead, 2016). Also, Woerner has discussed in her book '*Scheduling Home Health Care Personnel*' that to provide quality care, hobbies and interest matching is key (Woerner, 1988). For example, if a carer and a client like the same sport, it will be easier for them to make a connection, as while providing care, they can talk about the latest game (Home Care Pulse, 2014). Table 2.3 shows the key factors identified during the literature review of personal factors:

Table 2.3. Personal factors identified during literature review

Theme	Factor	References
Personal Factors	1. **Gender**	(Hansen, 2002), (Foster, 1989), (Coon, 2004), (Henry et al., 2002), (Kramer et al., 2002), (Spillman, 2000), (McCann et al., 2000), (U.S. Health and Human Service, 1998), (Metlife Mature Market Institute, 2003), (Pinquart et al., 2006), (Guberman et al., 2001),

Theme	Factor	References
	2. **Age**	(Hansen, 2002), (Hancock et al., 2007), (Alecxih, 2001), (U.S. Health and Human Services, 1998), (NAC & AARP, 2004), (Administration on Aging, NFCSP Complete Resource Guide, 2004), (Baltimore Johns Hopkins University, 2002)
	3. **Smoking**	(O'Sullivan, 2008), (Home Care Pulse, 2014), (Home Instead, 2016)
	4. **Hobbies**	(Home Instead, 2016), (Woerner, 1988)
	5. **Habits**	(Home Care Pulse, 2014), (Woerner, 1988),
	6. **Personality**	(Woerner, 1988), (Home Care Pulse, 2014)
	7. **Environment**	(Home Care Pulse, 2014), (Woerner, 1988)

2.2.2. Professional Factors

The nature of service required is another major factor in assigning carers to clients. Not all carers can provide all services. All agencies in Ireland offer a similar range of services in domiciliary care settings, as shown in **Appendix B** generic service. Generally, the majority of clients need assistance with activities of daily living (ADLs) as shown in Figure 2.6.

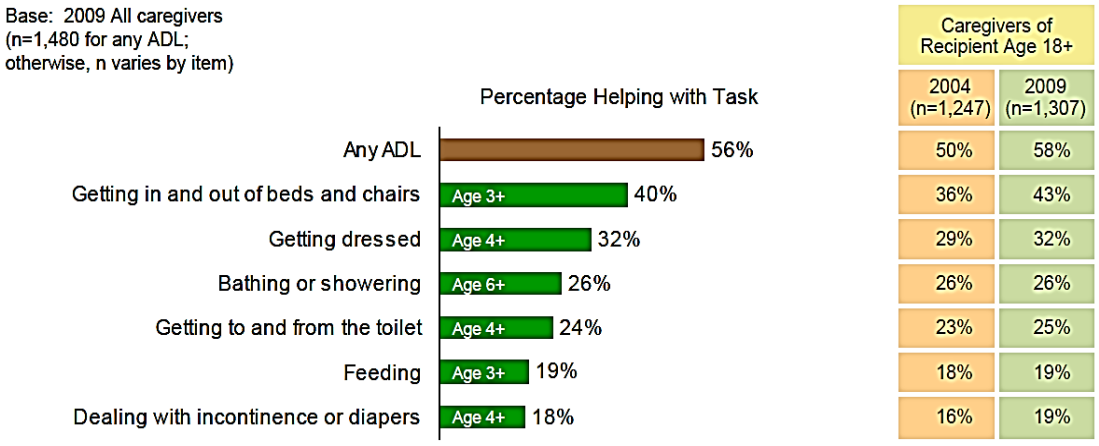

Figure 2.6. Activities of daily living (*NAC & AARP, 2009*)

Availability is another major factors involved in carer allocation. If a carer is not available, he/she cannot be scheduled. Nearly half of carers provide fewer than eight hours of care per week, while approximately one in five provide more than 40 hours of care per week. Older carers often spend the most hours providing care (Baltimore Johns Hopkins University, 2002). Nearly one-third (28%) of carers who provide more than 40 hours of care per week are over the age of 65 years (Baltimore Johns Hopkins University, 2002). The amount of time spent caring increases substantially as cognitive impairment worsens. Among people over the age of 70 years, those with no dementia receive an average of 4.6 hours of care per week, while those with mild dementia receive 13.1 hours of care weekly. For persons with severe dementia, hours of informal care received rises to 46.1 hours per week (Langa, 2001). Similarly, nearly one-quarter (23%) of carers of someone over the age of 50 years with some type of dementia provide over 40 hours of care per week compared to 16% of those helping someone over the age of 50 years without dementia (Alzheimer's Association and National Alliance for Caregiving, 2004). A study of California Carer Resource Center caregiving clients indicates that the average number of hours of care per week is 46 (Family Carer Alliance, 2005).

Experience is another key element in scheduling a carer. Carers with more experience are always preferred. The span of caregiving relationship between a carer and a client can last from less than a year to over 40 years providing care to a client. In a recent report, carers were found to spend an average of 4.3 years giving care (NAC and AARP, 2004). In another national study, more than 40% of carers had been giving help for 5 or more years, and about one-fifth had been doing so for longer (Donelan, 2002). Older carers (over the age of 50) will probably have been caregiving for over 10 years (17%) when compared with younger carers (9%) (NAC & AARP, 2004).

Knowing the carer was another major factor identified during the literature review. A known carer is a carer who has already worked for the client requiring service. According to a report by The National Council on Ageing and Older People (2004), long-term care can be improved in the community when individualised care is provided. If a client personally knows the carer and has a sense of being personally cared for, the care is more effective. It is important that the client and carer know each other; if they do not then there should be a proper introduction to facilitate quality care. A positive bond between carer and client improves the quality of care and quality of life (NCAOP, 2006). The research found that long-stay care facilities enhance the quality of life of residents when each resident is treated

as a unique individual whose 'life has been shaped by a variety of events, experiences, and circumstances' (NCAOP, 2005).

A family carer is another major factor; certain clients only require a family carer. The relationship of carer to a care receiver has also been shown to influence the extent to which interventions will be effective or not. In particular, spousal carers and children carers, while sharing similar needs, also present distinct challenges and needs that are important to consider when determining types of interventions. Kang (2006) found that predictors of carer emotional strain shared between adults, children and spouses included care recipients' disruptive behaviour, carer's perceived overload, family disagreement, limitations to the carer's life, and utilisation of personal coping strategies by the carer. However, the 'race' of the care recipient and availability of respite uniquely predicted adult carer strain. Regarding specific interventions, adult children carers were found to respond more favourably to counselling and education interventions than older spousal carers (Schoenmaker et al., 2010). While having a primary carer may be common, there are often many individuals involved in the provision of care. As such, interventions need to recognise that a 'constellation' of carers may exist with multiple individuals participating in the care and the decision-making process for care. The presence of multiple voices can add to the complexity of a caregiving situation such that carers may experience stress not only from the challenging behaviours of a care recipient but also from negotiating with the other participants in the carer role (Spector, 2000) (National Alliance for Caregiving and AARP, 2004).

Table 2.4. Carer relationship to the carer (*NAC and AARP, 2004*)

Relationship to Older Person	% of All Caregivers (caring for person 65+)	% of All Caregivers (caring for person 50+)
Child	41%	44%
Spouse	23%	6%
Other relative	27%	24%
Nonrelative	8%	14%

As shown in the table above, there is a much higher probability of accepting care from a relative, and almost one-quarter of carers who are themselves over the age of 65 are

supporting a life partner (NAC & AARP, 2004). Some studies have found that a critical rate of carers, 17% to 24%, are friends or neighbours of the care recipient rather than a relative. In a national sample of carers who live with their care receiver, partners represent around 62% of primary carers while adults comprise 26%. Secondary carers are more likely to be adult children (46%) than spouses (16%) (Kennedy et al., 1997).

Skill set was another major factor identified during the literature review. Carers need to be qualified to take care of the client's needs (Woerner, 1988). Factors includes: does the client require specific medical attention or health tests that the carer will need to know how to administer? Does the carer know how to perform first aid or CPR, work an oxygen tank or manage medication? Should the assigned carer be a CNA (Certified Nursing Assistant)? According to the U.S. Department of Veterans Affairs (DoVA), carers must have the skill set necessary to perform daily routines task such as reading vital signs, infection control/avoidance, skin care, and medication management and pain management (U.S. DoVA, 2011). Sending a carer into a situation unprepared can result in confusion, frustration, and disappointment for both the carer and the client. On the other hand, sending a qualified carer who can appropriately and confidently take care of a client's needs will reassure the client that they are in good hands (Home Care Pulse, 2014).

Working duration limitation is another factor that needs to be taken into consideration. For example, how many hours can a carer work per week? Each country has working hours' directives and legislation, and carers are bound by these. According to Irish law, employees can work 48 hours a week, which means that a case management system can only schedule carers for this duration. If required hours of care go above this limit, it is not legally permitted to schedule the same carer (Organisation of Working Time Act, 1997). Table 2.5 shows the key factors identified during the literature review of professional factors:

Table 2.5. Professional factors identified during literature review

Theme	Factors	References
Professional Factors	**1. Services needed**	(NAC & AARP, 2009)
	2. Availability	(Baltimore Johns Hopkins University, 2002), (Langa, 2001), (Alzheimer's Association and National Alliance for Caregiving, 2004), (Family Carer Alliance, 2005)

Theme	Factors	References
	3. Experience	(NAC and AARP, 2004), (Donelan, 2002),
	4. Known Carer	(NCAOP, 2006)
	5. Family Carer	(Kang, 2006), (Schoenmaker et al., 2010), (Spector, 2000), (National Alliance for Caregiving and AARP, 2004), (NAC & AARP, 2004), (Kennedy et al., 1997)
	6. Skills	(Home Care Pulse, 2004)
	7. Legal	(Organisation of Working Time Act, 1997)

2.2.3. Geographic Factors

Carer location is another major factor for scheduling. For example, carers who live close-by are preferred because it will decrease the travelling time and more time can be spent on care. Similarly, job location is a large factor in carer contentment (Woerner, 1998). As discussed in the research background section, scheduling domiciliary care staff in domiciliary care settings is a combination of a staff scheduling problem (Ernst et al., 2004) and a vehicle routeing problem (VRP) (Cordeau et al., 2001). According to Rasmussen (2011), carer scheduling is a vehicle routeing problem with time windows; it is important to understand that there are travel times that must be understood when scheduling the carer (Rasmussen et al., 2011). According to Home Care Pulse, carers are very appreciative of a care provider agency efforts to place them in a client's home that is near their home. This can also be beneficial for a care provider agency when a client calls and needs help unexpectedly and quickly. A nearby carer can get there faster (Home Care Pulse, 2014). Figure 2.7 shows U.S. based data on average travel time spent by carers:

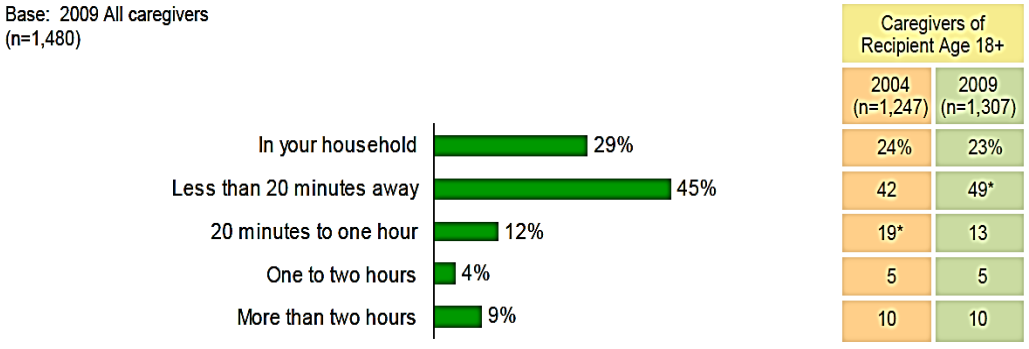

Figure 2.7. Distance from the client house (*NAC & AARP, 2004, 2009*)

- The majority of carers (42%) live within 20 minutes of the care recipient. One-quarter of care recipients (24%) live with the carer, and another fifth (19%) live within an hour of the care recipient. The remaining 15% of carers live more than an hour from the care recipient (National Alliance for Caregiving and AARP, 2004).
- Estimates of the number of long-distance carers in the U.S. who are caring for an older relative range from 5.163 million to nearly 7 million (Wagner, 1997).
- Long-distance carers are generally defined as living more than one hour from the older adult needing assistance. Estimates of travel time for long-distance carers to visit the care recipient range from 4 hours to 7.23 hours (Metlife Mature Market Institute and National Alliance for Caregiving, 2004).

Office branch and groups division of carers was another factor identified. In Ireland, carers can work in different branches of the same organisation; this is based on the individual company policy. Some organisations prefer that their carers work only from one office, or selected offices or all offices. Within an organisation carers can be divided into multiple groups based on the area of staff management or scheduling management. Depending on the organisational policy carers may be allocated to one or multiple groups (IHC, 2016). Table 2.6 shows the key factors identified during literature review of geographic factors:

Table 2.6. Geographic factors identified during literature review

Literature Review Summary of Geographic Factors		
Theme	**Factor**	**References**
Geographic Factors	1. Location	(Home Care Pulse, 2014), (NAC & AARP, 2009), (Wagner, 1997), (Metlife Mature Market Institute and National Alliance for Caregiving, 2004),
	2. Office Branches	(IHC, 2016)
	3. Office Groups	(IHC, 2016)

2.2.4. Cultural Factors

Language is one of the major factors in domiciliary care scheduling. Carers with the same language as a client should always be preferred (Woerner, 1988). It is important that client and carer should be able to speak with each other, due to the fact that quality care can more easily be provided where there are no communication barriers. Additionally, the nationality of both client and carer should be considered before scheduling a carer (Home Care Pulse, 2014).

Ethnicity is also a factor in carer allocation. Sometimes a client is more comfortable with a carer who is of the same ethnicity as themselves, for better understanding. According to the Public Health Agency of Canada (2003), "*Some persons or groups may face additional health risks due to a socio-economic environment, which is widely determined by dominant cultural values that contribute to the perpetuation of conditions such as marginalization, stigmatization, loss or devaluation of language and culture and lack of access to culturally appropriate health care and services*". A highly promising intervention for Chinese female carers demonstrates that interventions can be successfully tailored to accommodate ethnocultural beliefs about dementia. Specifically, (Gallagher-Thompson et al., 2007) an in-home behavioural management (IBHM) psychoeducational support program was provided, based on CBT theoretical underpinnings. This intervention was able to show significant effects on carer depressive symptoms and carer related stress. The decision to modify components of the intervention, such as delivery of the behavioural management in-home versus an external setting, and to adapt the language and communication style (e.g. rephrasing "assertiveness training" to "practicing ways to communicate effectively with those who can assist with caregiving", as well as particular content issues (e.g. the perception that it is shameful for spouses to seek help from adult children), were made by consulting with focus groups of individuals before the implementation of the program.

Rates of caregiving shift to some degree by ethnicity. Among the U.S. adult population (over the age of 18 years), around one-fifth (21%) of both the white and African-American populaces are giving casual care, while a marginally lower rate of Asian-Americans (18%) and Hispanic-Americans (16%) are occupied with caregiving (NAC & AARP, 2004). However, in another national review which took a look at individuals 70+ years of age, 44% of Latinos were found to receive casual domiciliary care, contrasted with 34% of African-Americans and 25% of non-Hispanic whites (Weiss, 2005). Studies demonstrate that ethnic

minority carers give more care than their white partners and report a lower level of physical well-being than white carers (Pinquart et al., 2005). Alternatively, Hispanic and Asian-American carers display more dissatisfaction than white carers (Cuellar, 2002) (Haley, 2004) (Pinquart, 2005). Ethnic differences are also found with regard to the care recipient. Among people aged 70+ who require care, white people are the most likely to receive help from their spouses; Hispanics are the most likely to receive help from their adult children; and African Americans are the most likely to receive help from a nonfamily member (National Academy on an Aging Society, 2000). Table 2.7 shows the key factors identified during the literature review of cultural factors:

Table 2.7. Cultural factors identified during literature review

Theme	Factor	References
Cultural Factors	**1. Language**	(Foster, 1989), (Woerner, 1988), (Home Care Pulse, 2014)
	2. Ethnicity	(Public Health Agency of Canada, 2003), (Gallagher-Thompson et al., 2007), (NAC & AARP, 2004), (Weiss, 2005), (Pinquart et al., 2005), (Cuellar, 2002) (Haley, 2004) (Pinquart, 2005), (National Academy on an Aging Society, 2000)

2.2.5. Conclusion

The literature review established that there are many factors involved in carer scheduling. These factors are categorised into four themes: personal, geographic, professional and cultural. Table 2.8 shows a list of all key factors identified during the literature review in each theme:

Table 2.8. Themes and factors identified during the literature review

Themes	Factors Identified	References
Personal Factors	**1. Gender**	(Hansen, 2002), (Foster, 1989), (Coon, 2004), (KFF, 2002), (Kramer et al., 2002), (Spillman, 2000), (McCann et al., 2000), (U.S. Health and Human Service, 1998), (Metlife Mature Market Institute, 2003), (Pinquart et al., 2006), (Guberman et al., 2001),
	2. Age	(Hansen, 2002), (Hancock et al., 2007), (Alecxih, 2001), (U.S. Health and Human Services, 1998), (NAC & AARP, 2004), (Administration on Aging, NFCSP Complete Resource Guide, 2004), (Baltimore Johns Hopkins University, 2002)
	3. Smoking	(O'Sullivan, 2008), (Home Care Pulse, 2014), (Home Instead, 2016)
	4. Hobbies (like, dislikes)	(Home Instead, 2016), (Woerner, 1988),
	5. Habits (personal traits)	(Home Care Pulse, 2014), (Woerner, 1988),
Geographic Factors	**6. Location** (area of client and carer)	(Home Care Pulse, 2014), (NAC & AARP, 2009), (Wagner, 1997), (Metlife Mature Market Institute and National Alliance for Caregiving, 2004),
	7. Office Branches	(IHC, 2016)
	8. Office Groups (service areas)	(IHC, 2016)

Themes	Factors Identified	References
Professional Factors	**9. Services Needed**	(NAC & AARP, 2009)
	10. Availability	(Baltimore Johns Hopkins University, 2002), (Langa, 2001), (Alzheimer's Association and National Alliance for Caregiving, 2004), (Family Carer Alliance, 2005)
	11. Experience	(NAC and AARP, 2004), (Donelan, 2002),
	12. Known Carer	(NCAOP, 2006)
	13. Family Carer	(Kang, 2006), (Schoenmaker et al., 2010), (Spector, 2000) (National Alliance for Caregiving and AARP, 2004), (NAC & AARP, 2004), (Kennedy et al., 1997)
	14. Skill set	(Woerner, 1988) (Home Care Pulse, 2004)
	15. Legal	(Organisation of Working Time Act, 1997)
Cultural Factors	**16. Language**	(Foster, 1989) (Woerner, 1988) (Home Care Pulse, 2014)
	17. Ethnicity	(Public Health Agency of Canada, 2003), (Gallagher-Thompson et al., 2007), (NAC & AARP, 2004), (Weiss, 2005), (Pinquart et al., 2005), (Cuellar, 2002) (Haley, 2004) (Pinquart, 2005), (National Academy on an Aging Society, 2000), (Schoenmaker et al., 2010)

Figure 2.8 shows the key factors identified during the literature review:

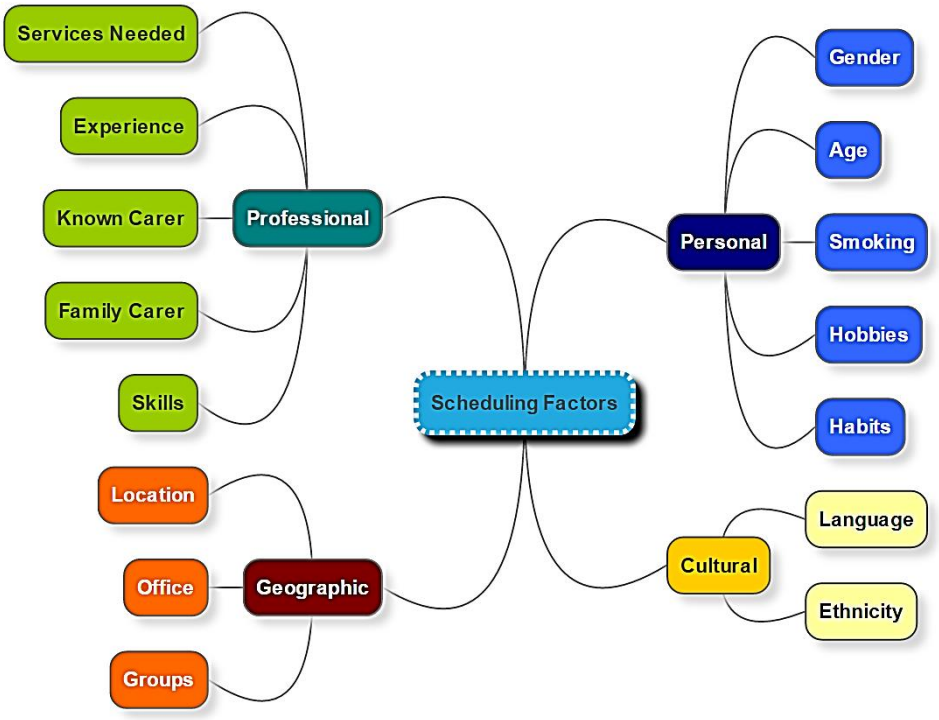

Figure 2.8. Themes and key factors identified during literature review

2.3. Literature Review of Factors Weighting

While applying the factors to scheduling the carer, consideration must also be given to the fact that one factor can be more important than another. Therefore, there must be factor weighting, in order to identify what takes precedence during such scenarios. According to the Oxford dictionary, 'Weighting' is an allowance or adjustment made in order to take account of special circumstances or compensate for a distorting factor. The literature review indicated that there were different patterns for each factor. For example 66% of carers were female and 34% were male (NAC & AARP, 2009), but there was no weighting found between different factors.

2.4. Literature Review of Constraints

The literature review does show that factors can be treated as constraints which need to be satisfied. According to Dingzhu, there are two types of constraints: soft and hard. Hard constraints: if this constraint fails then the entire schedule is invalid. Soft constraints: it is desirable that these constraints are met but not meeting them doesn't make the schedule invalid. For example, availability is a hard constraint while ethnicity is a soft constraint. Soft constraints can be ignored when matching carers and clients, but hard constraints must be satisfied (Dingzhu, 1997). Acording to the Organisation of Working Time Act (1997) a carer can only work 48 hours a week: this means that it is a hard constraint for all carers. In addition, a carer cannot be at two places at the same time: thus availability is another hard constraint that needs to be satisfied for all carers.

Table 2.9. Hard constraints identified during the literature review

ID	Key Factor	Hard Constraint
1	Working Hours Duration	☑
2	Availability	☑

2.5. Literature Review of Scheduling Algorithms

The literature review also indicated that a significant amount of carers are currently using some sort of technology for work. U.S. based figures show that about 45% of carers use some technology (NAC & AARP, 2009). Various scheduling algorithms used for scheduling were identified during the literature review, as listed below:

- Binary Integer Programming (BIP) (Thomas, 2013)
- Linear Programming (LP) (Naik, 2005)
- Decision Matrix (DM) (Eiselt, 2013)

2.6. Conclusion

The literature review indicates that there are factors that influence carer scheduling and these are categorised into various categories. Some of the factors were also considered as a hard constraint. However, literature review did not identify many findings on the weighting of the factors. The review also indicated that different technologies and algorithms can be used to solve the scheduling problem and to manage the scheduling process.

Chapter 3

Research Methodology

3.1. Introduction

This chapter outlines the methodology adopted by the researcher, how data will be collected, analysed and correlated with the research question. Who are the stakeholders? How many participants will be interviewed? What will be the research method? Technical design and implementation strategy will also be discussed in this chapter.

3.2. Literature Review

According to Creswell (2009), a prerequisite in the research process is to review the literature thoroughly to reduce and refine the scope of a proposed study. To focus on specific literature required to address the research question, a list of literature requirements and research goals was developed. Also, themes were identified and used as a basis for the literature review, as discussed in detail in the literature review section. The primary purpose of the literature review was to gather information on the following areas:

- What are the key factors, weightings, and constraints for carer scheduling?
- Determine the themes in which each factor can be categorised?
- What are the scheduling algorithms available?
- Identify the stakeholders
- Identify the methodology to be used

3.3. Identification of Stakeholders

The literature review indicated that there are many stakeholders, but the following were the key stakeholders:

1. **Care Manager Group**

   These are the stakeholders responsible for scheduling carers on a daily basis and providing quality care. The questionnaire for the care manager group is available in **Appendix C.2**. Correlation between the research objectives and questionnaire can be found in **Appendix M.2**.

2. **Carer Group**

   These are the stakeholders responsible for helping clients in daily activities or assisted living. The questionnaire for the carer group is available in **Appendix C.3**. Correlation between the research objectives and questionnaire can be found in **Appendix M.3**.

3. **Client Group**

   These are the stakeholders who are mostly elderly and need care at home. The questionnaire for the client group is available in **Appendix C.1**. Correlation between the research objectives and questionnaire can be found in **Appendix M.1**.

4. **HSE Commissioner Group**

   The main focus of this research is on the previous three groups (care manager, carer and client). However, to get the HSE commissioners perspective, at least one interview with a commissioner (funder) of these services was scheduled. The questionnaire for the HSE commissioner is available in **Appendix C.4**. Correlation between the research objectives and questionnaire can be found in **Appendix M.4**.

3.4. Research Method

This research uses a mixture of qualitative and quantitative methods. Qualitative research is typically based on descriptive data, while quantitative research depends on numeric data (Creswell, 2009). For the purpose of this study, a combination of both types of research methods provides good results. Initially, participants were asked to give their view on what are the key factors so that qualitative data on identification of key factors could be gathered. They were then asked to provide weightings on the factors they identified and factors identified by others. They could omit the factor they did not think was a key factor.

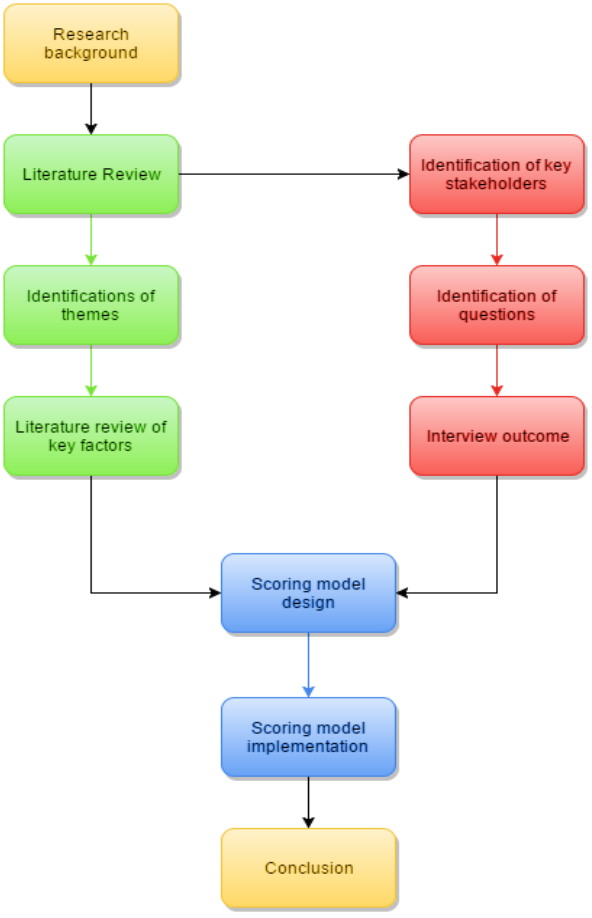

Figure 3.1. Research framework used this in this research

3.5. Scoring Model Analysis

Semi-structured interviews were conducted with the stakeholders as identified previously. Participants were selected randomly from various private and voluntary organisations; at least one participant from each group were selected. Each interview was expected to last for 20-30 minutes. Interviews were audio recorded and recordings will be securely stored on a password protected USB device. Prior to the interviews an ethical approval application was prepared by the researcher and it was approved by the ethics committee (see **Appendix A)**. There were three major components to the interviews: identifying the key factors, weightings and constraints. Participants were asked to give their view on what are the key factors, weightings and constraints, using the qualitative method to define the areas to be explored, but also allowing the interviewer or interviewee to deviate in order to pursue an idea or response in more detail. This approach is commonly used in healthcare and was deemed a suitable interview format to identify the key factors, as it provides participants with some guidance on what to talk about, which many find helpful (Gill et al., 2008). The flexibility of this approach, particularly compared to structured interviews, also allows for the discovery or elaboration of information that is important to participants but may not have previously been thought of as pertinent by the research team. To gain more insight on the weighting, participants were asked to give weighting to the factors they identified and factors identified during the literature review and by other stakeholders. However, participants can skip a factor if they do not consider it to be a key factor. Following all the interviews, the researcher performed the analysis based on the notes taken during the interviews and analysed the recording to get the stakeholder perspective. This research focuses on the scheduling factors from a carer's perspective, which would have no impact on actual mistreatment of a client. This research did not impact client treatment or time of treatment or anything related to patient care plans.

3.6. Scoring Model Discussion and Design

Based on the literature review and interview results, a scoring model was developed. To verify the scoring model, the researcher designed and use an algorithm to review the findings. The purpose of this design is to prove programmatically that the scoring model is producing the required results. The following were the objectives for system design:

- Finalise the key factors, weightings, and constraints

- Develop the scorecard and scoring model decision support system design

3.7. System Model Implementation

In this section, a scoring model decision support system was implemented and tested using a computer based program. Implementation was performed using Microsoft Visual Basic and Microsoft Access database due to the fact there are no additional components required. User with Microsoft Office could access the program, add/update data, run the program and view results. Also, the source code was easily viewable. The purpose of this implementation was ensure that the system design is flawless and that it would work for small to medium organisations for scheduling. The following are the objectives for the system implementation:

- System implementation is simple and achievable
- Put the scoring model design to a real test using a computer based program
- Evaluate the system design
- Determine the limitation of the system design
- Identify any improvements that can be carried out in the system design

3.8. Conclusion

This chapter explains the approach that the researcher adopted for this research. Based on the literature review the methodology was designed. The researcher used a mixture of both qualitative and quantitative research methods for this research. Semi-structured interviews were conducted, and based on the interview results the researcher performed the analysis of the scoring model. The literature review and analysis was discussed; based on this a scorecard and scoring model decision support system design was developed. Finally, the scoring model was implemented and evaluated.

Chapter 4

Scoring Model Analysis

4.1. Introduction

In this chapter the researcher established an Irish perspective for the research. To gain the Irish perspective interviews were scheduled with 15 participants from five different domiciliary care providers, two clients who are receiving care and one HSE commissioner for HCP funding. The outcome is analysed in this chapter.

4.2. Interview Analysis of Key Factors

In this section key factor analysis is performed based on interview outcome. Weightings and constraints are discussed in the next section.

4.2.1. Care Manager Perspective Analysis

Care managers have a very challenging job. They receive a referral for a client who needs care. If the referral is from the HSE they will establish a preliminary assessment and care plan. Generally, they will perform their own assessment and based on this they will create a care plan in agreement with the client. Following this the carer has to be scheduled. It is a challenging job to find the best suited carer. There are various factors that may influence the reason for choosing a certain carer. The interview questionnaire for care managers is available in **Appendix C.2**. Face to face semi-structured interviews were conducted with

eight care managers from Dublin-based private and voluntary agencies. Sample notes and sheets from one interview are available in **Appendix L**. Questions and interview analysis correlation can be found in **Appendix I.2**. Detailed analysis of key factors arranged by themes is available in **Appendix D**.

Interviewees were asked questions to obtain details on the key factors they need to take into consideration before scheduling a carer for a client. Firstly, they were asked questions which helped the researcher to identify the key factors. All care managers agreed that availability of carer was one of the major factors. In Ireland, carers normally work on '*Zero Hours Contracts*', which means they do not have any fixed time of work. Instead, they are paid for the number of hours they work, so a carer might not have a fixed working hours, but can work any time care provider needs them to, which may not suit the carer. Another factor that all care managers agreed about was on making sure that a carer is Garda vetted, especially if the carer is not a family carer. This is a very important factor for the safety of a client. In Ireland, carers cannot legally work more than 48 hours a week and this is based on an EU Time Directive (Organisation of Working Time Act, 1997). Care managers agreed that this was another important factor that must be taken into account. Location of client and carer was another major factor identified by all care managers: it is important to make sure that more time is spent on caring and less time on travelling. However, care managers also mentioned that they find location very challenging to manage, and some carers have to travel to a different area to provide care. Language was another factor identified by all care managers as a very important factor for scheduling care. Clients feel more comfortable with a carer with whom s/he can communicate easily. About 88% of care managers agreed that age and gender was another major factor when scheduling a carer. Sometimes a client would request a specific gender and age. This pattern is mostly noticeable in the cases of younger clients who need care. Services needed by client and skillset of carer was another major factor: 88% care managers stated that to provide quality care they need to make sure a carer with the relevant skillset is scheduled. Sometime clients will prefer a carer that is already known to him or her. A known carer is aware of a client's routine and knows how to manage the client, whereas if a new carer is sent he needs to be briefed about the client. Client and carer habit match was another factor identified by 75% of care managers as helping the quality of care. Matching the carer and client with the same habits will ensure that the client is more comfortable with the care. Another factor reported by the care managers was pets: some carers have pet allergies and they would not like to go to clients who have animals at home. Experience was also identified as a key factor: some clients are very dependent and they need very experienced carers. In some cases, a client requires

a family carer; for example, a granddaughter caring for her grandfather. This can be very important depending on the particular needs of the client. 63% of care managers identified smoking as a key factor, even though in Ireland carers cannot smoke in a client's house, and new legislation has also placed a restriction on the client smoking when the carer is working at his home, but still clients may prefer not to have a non-smoking carer. The client's home environment was another factor identified during interviews: a carer may refuse to go to a client's house if the conditions inside the house are not acceptable. 50% of care managers would prefer to schedule carers and clients who have the same hobbies. Similar hobbies could encourage carer and client to talk about the hobbies and have quality time together. Personality was another factor identified during the interviews: 50% of care managers would give special consideration to personality matching when matching up carer and client. For example, if a carer is talkative a preference would be to schedule a carer with a client who is also talkative rather than sending her/him to a quiet client. Another factor identified by care mangers was health and safety. 50% of care managers feel this is an important factor as there could be hazards associated with a client's health or house conditions that could pose a danger to a carer; for example, a client may have a contagious disease. Therefore, it is important that the carer be informed of such hazards so that he or she is prepared. Ethnicity was another factor identified during the interviews: some elder clients may prefer carers of the same ethnicity as they feel more comfortable. Figure 4.1 shows a summary of all the factors identified during the interviews with care managers and how many care managers consider a factor to be a key factor:

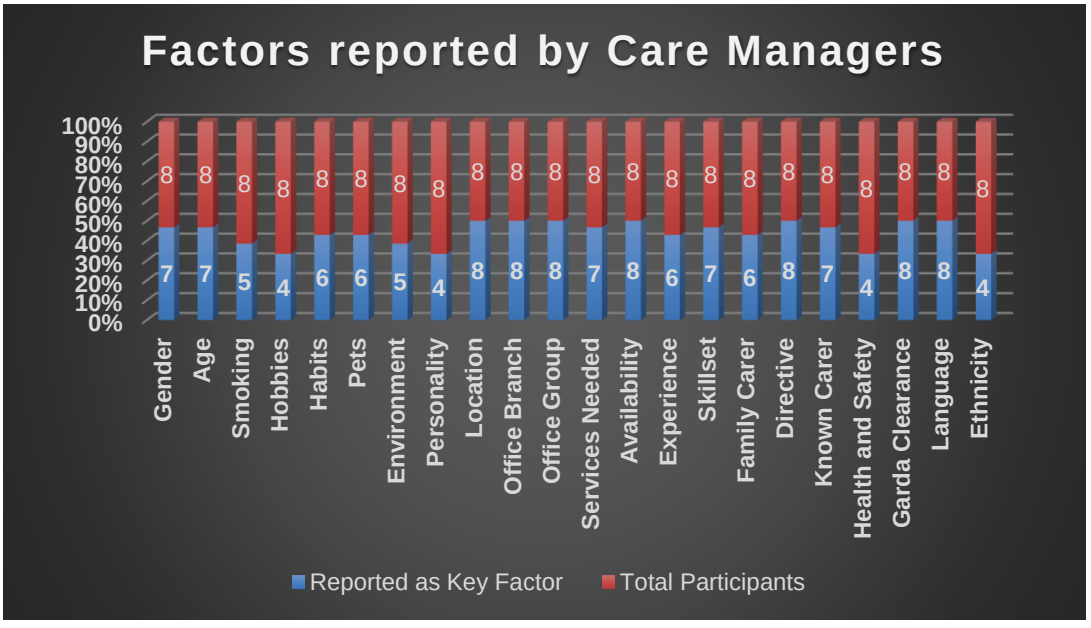

Figure 4.1. Key factor analysis based on care manager interviews

4.2.2. Carer Perspective Analysis

The carer is the person who provides the care. Semi-structured face to face interviews were conducted with six carers. The interview questionnaire for the carers is available in **Appendix C.3**. Questions and interview analysis correlation can be found in **Appendix I.3**. Detailed analysis of key factors sorted by themes is available in **Appendix D**.

All the carers agreed that location was one of the major factors that help them in daily tasks. Visiting a nearby client was very helpful in their job as they do not have to spend a lot of time travelling. 83% of carers said that gender was a key factor, but it is not something that would stop them from going to a client. However, they felt more comfortable with the same gender. 67% of carers identified age as another important factor. Carers felt more comfortable with the same age group. 50% of carers mentioned smoking as a key factor for scheduling. 33% of carers said that they would prefer clients with the same hobbies and habits. 83% of carers reported that clients with pets and a client's environment were also important factors to consider while providing care to the client; they must feel safe to work effectively. 67% of carers mentioned that personality match was an important factor that would make their job easier. Services needed by the client was another factor agreed upon as important by 83% of carers, as they would need to know what the client's needs are before assisting the client. 67% of carers felt that skillset and training are important factors for providing quality care, and they would like to be trained before they provide any service to a client. 50% of carers stated family carer as a key factor in certain situations where a family member would insist on care from a family carer rather than an outside carer. However, they also mentioned that this may only be important from a client's care quality point of view, while from a carer's perspective it does not matter because as a carer they treat all clients the same way. Knowing the client/carer was another factor 83% of carers agreed upon as it makes their job easier if they know the client already, as they know the client's routine and any assistance he or she needs. 50% of carers reported that health and safety were other factors they would consider before visiting a client. A client's house may not be a suitable place to work from a health and safety point of view, or a client may have a contagious disease, and a carer would like to know these things before visiting a client so that they can be prepared. 83% of carers said that language was also an important factor. They would prefer to work for a client with the same language, as it is easier to communicate. 50% of carers stated that ethnicity is a major factor from a client point of view, as clients feel more comfortable with the same ethnicity; however, from a carer's point

of view, it did not matter as they provide care to all clients in the same way. Figure 4.2 shows a summary of all the factors identified during the interviews with carers and how many carers consider a factor to be a key factor:

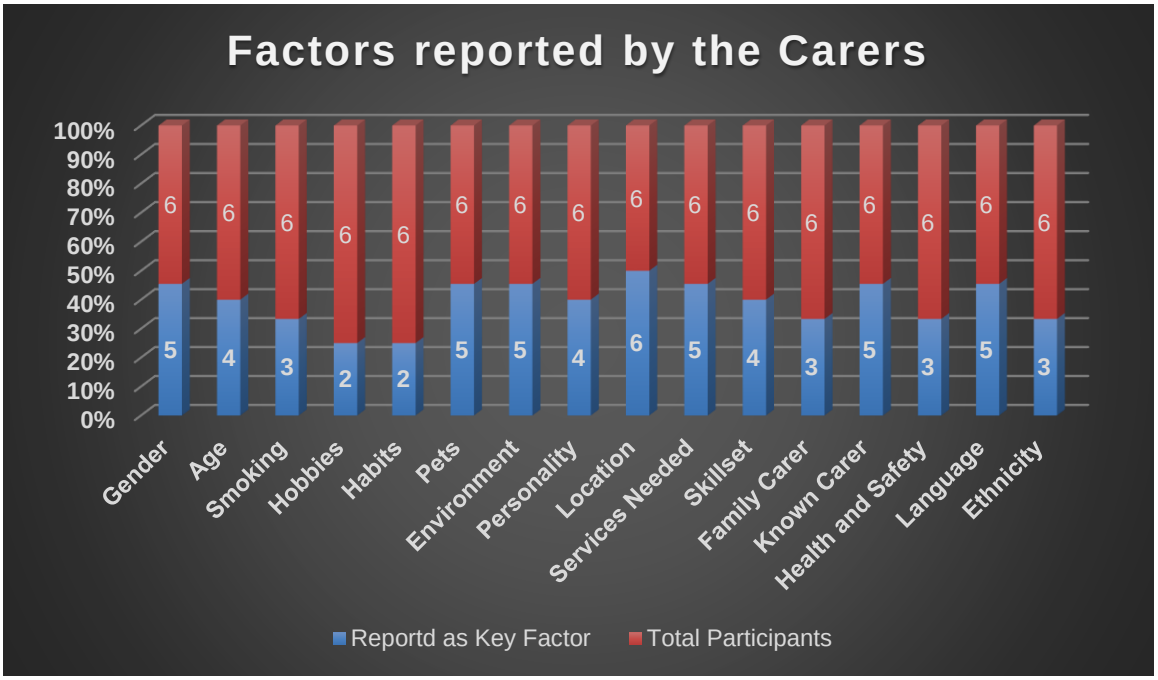

Figure 4.2. Key factor analysis based on carer interviews

4.2.3. Client Perspective Analysis

The client is the person who needs domiciliary care. Generally, clients live alone at home and need assistance to carry out day-to-day tasks. Assistance required by clients may vary from client to client. Clients can be categorised into three categories from a service requirement severity viewpoint: these are normal, medium and high, as discussed above in detail. Some of these clients are very ill and need special care. To provide quality care, it is essential that carers can understand their needs and be very friendly. Clients may act in an odd manner from time to time due to an illness they may have. Carers need to ensure they act professionally and stay friendly. Interviews with clients were organised by the care managers: two clients were interviewed. The interview questionnaire for clients is available in **Appendix C.1**. Questions and interview analysis correlation can be found in **Appendix I.1**. Detailed analysis of key factors is available in **Appendix D**. 50% of clients mentioned gender and age as the key factor as they feel more comfortable with the same gender and age group. All the clients stated smoking as an important factor; the non-smoking clients

would prefer a non-smoking carer even though carers are not allowed to smoke on the client's premises. 50% of clients agreed that they would prefer a carer with similar personality, habits and hobbies so that they can talk about similar interests and have quality time together. All the clients who were interviewed agreed that the experience and skillset of the carer is a major factor: they prefer a carer who is skilled and experienced. 50% of clients stated that they would prefer a family carer whereas all the clients agreed that they would prefer a carer who is already known to them and has worked with them before. All the clients agreed that carers must be Garda vetted before he or she is sent to the client's house. 50% of clients stated that they would prefer the carer with the same ethnic value as he or she will be more understanding. All the clients indicated that language is a major factor, and they would like someone with the same language. Figure 4.3 shows a summary of all the factors identified during the interviews with clients and how many clients consider the factor a key factor:

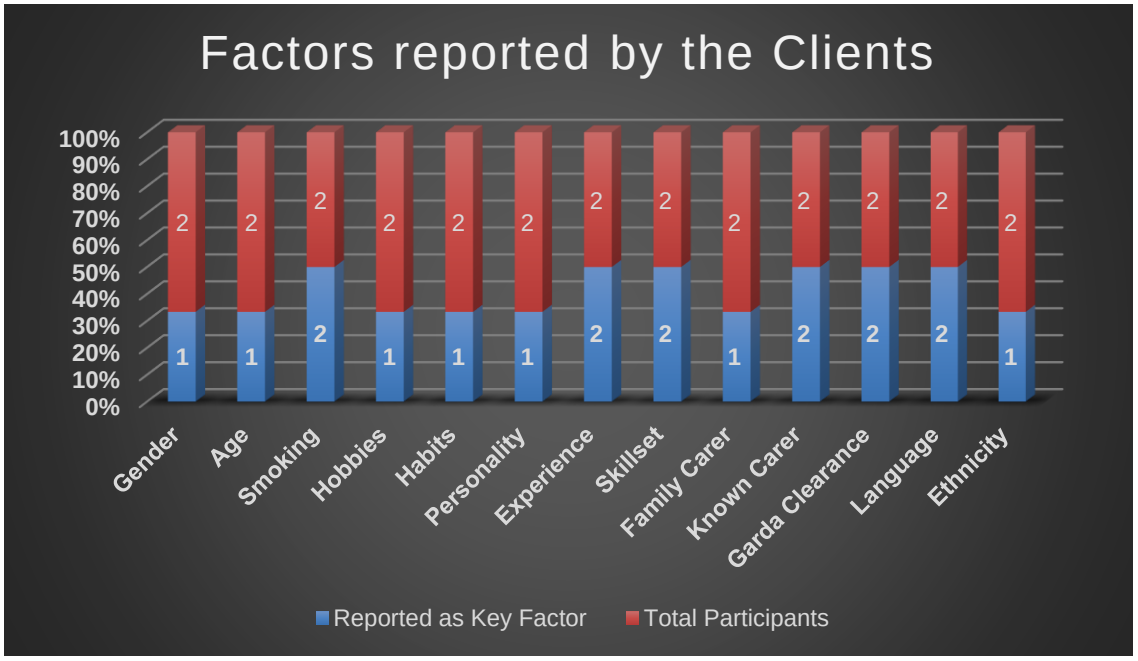

Figure 4.3. Key factor analysis based on client interviews

4.2.4. HSE Commissioners Perspective

Interviews mostly focused on care managers, carers and client groups. However, to get the HSE commissioner perspective, an interview was scheduled with a senior commissioner. In Ireland home care is mostly provided through HSE funding. Even though a client can

receive informal care from private agencies, a vast majority is receiving service via the HSE. HSE commissioners manage the funding and thus need to ensure the SLAs between HSE and care provider agencies are met. They want quality service and transparency with the service provided. The interview questionnaire for HSE commissioner is available in **Appendix C.4**. Questions and interview analysis correlation is available in **Appendix I.4**.

An interview was conducted with one HSE commissioner; his major concern was that care provider agencies meet their SLAs with the HSE. Agencies must have proper insurance in place. Carers must be fully qualified and trained. Carers must provide care for the full agreed hours. Carers must be Garda vetted before being sent to the client:

Figure 4.4. Key factor analysis based on HSE Commissioner interview

4.3. Interview Analysis of Weighting

This section describes the outcomes of weighting analysis based on interviews. Each interviewee was asked to give weightings to each factor (between1-5), 1 being least important and 5 being the most important factor. However, if a participant did not feel the factor was important, by default weighting one was given. Initially, the plan was to keep a separate priority for each factor, but later the researcher decided not to use priority as weighting and constraints were enough to design the system while keeping it simple.

4.3.1. Care Manager Weighting Perspective

During face to face interviews, care managers were asked to give weighting to each factor in terms of their importance. Questions and weighting correlation analysis are available in **Appendix I**. Eight carer managers were interviewed; each of them had given a weighting to each factor (between1-5). Following this, the average was calculated for each factor. Details of the weighting given by each care manager are sorted by theme and available in **Appendix E**. Figure 4.5 shows the average given to each factor during interviews by care managers:

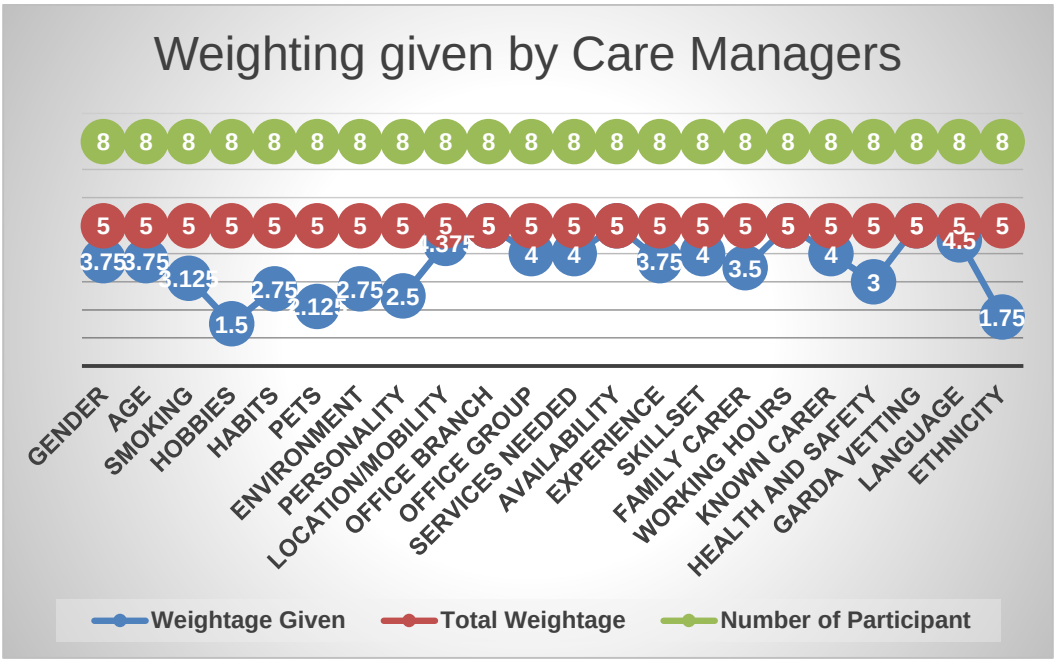

Figure 4.5. Weighting analysis based on care manager interviews

4.3.2. Carer Weighting Perspective

During face to face interviews, carers were asked to give a weighting to each factor in terms of their importance. Questions and weighting correlation analysis are available in the **Appendix I**. Six carers were interviewed; each of them gave a weighting to each factor (between1-5). Following this, the average was calculated for each factor. Details of the weighting given by each carer are sorted by theme and available in **Appendix E**. Figure 4.6 shows the average given to each factor during interviews with carers:

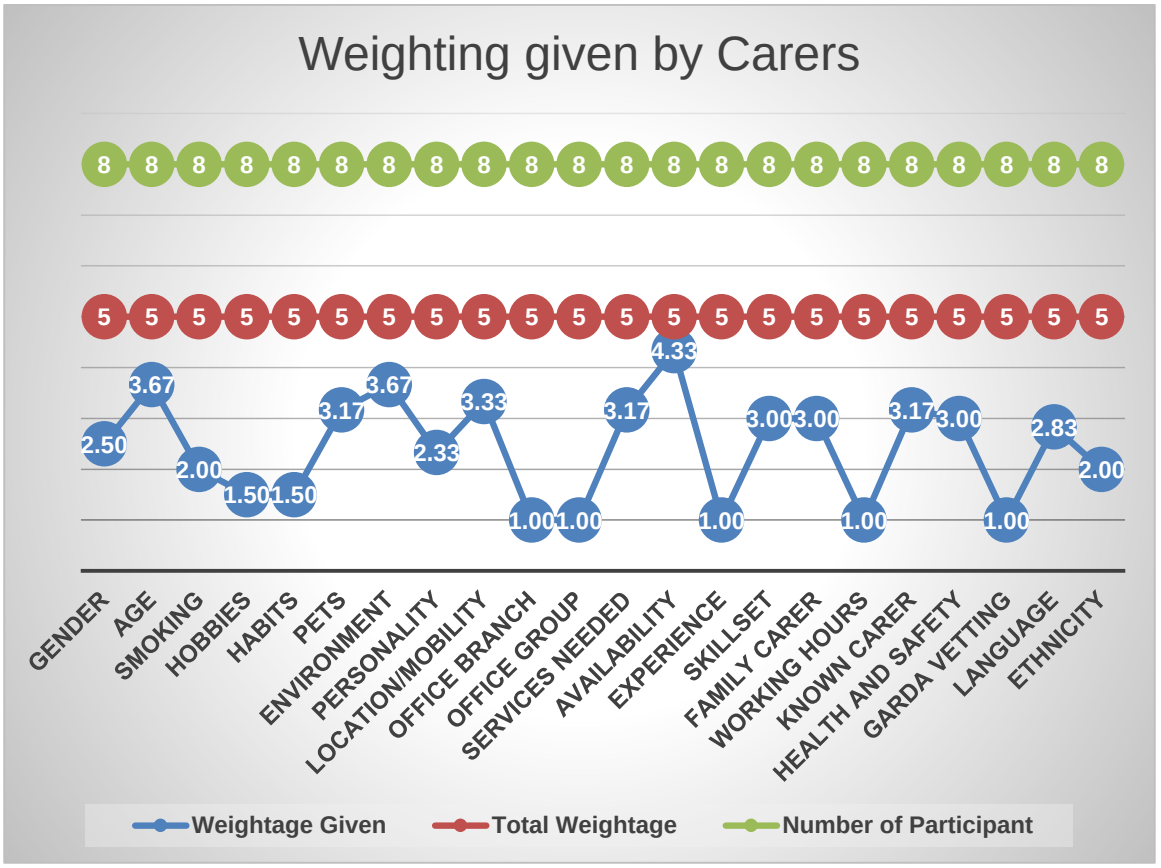

Figure 4.6. Weighting analysis based on carer interviews

4.3.3. Client Weighting Perspective

Care manager-assisted interviews with clients were conducted. Clients were asked to give a weighting to each factor in terms of their importance. Questions and weighting correlation analysis are available in the **Appendix I**. Two clients were interviewed; each of them gave a weighting to each factor (between1-5). Following this, the average was calculated for each factor. Details of the weighting given to each factor are available in **Appendix E**.

Figure 4.7 shows average give to each factor during interviews by clients:

Figure 4.7. Weighting analysis based on client interviews

4.4. Hard Constraints Analysis

During the interviews all stakeholders (excluding the HSE Commissioner) were asked to specify any constraints when scheduling. Constraint questions were embedded in the interview questionnaire, available in **Appendix C**. Questions and interview analysis correlation can be found in **Appendix I**. Factors marked as **(must)** were reported as hard constraints.

During the interview almost all the stakeholders agreed that availability, working hours and Garda clearance are the hard constraints: these must be met before the carer can be scheduled. However, in the case of a family carer, Garda clearance was not necessary. On the other hand, some clients may have special needs due to which a factor may become a hard constraint for them, but in general the above mentioned are the three constraints that would be applicable all of the time.

Table 4.1 shows the hard constraints: carers must satisfy these in order to be scheduled to a client:

Table 4.1. Hard constraints

	Theme	Factors	Hard Constraints
1	Professional	Availability	☑
2	Professional	Working Hour Time Directive	☑
3	Professional	Garda Clearance	☑

4.5. Scheduling Algorithms Analysis

During interviews, it was identified that most care provider organiations are using some computer-based software to assist with their scheduling. However, there were limitations regarding identifying a suitable carer. In most cases care managers had to figure it out normally by checking the availability of each carer and client needs.

4.6. Conclusion

Stakeholders were identified, and a questionnaire was developed. Semi-structured interviews were scheduled with 14 participants from five different domiciliary care providers, two clients who are receiving care and one HSE commissioner for Home Care Package (HCP) funding. Based on the interviews analysis, key factors, weighting and constraints were identified for further discussion in the next chapter.

Chapter 5

Scoring Model Discussion and Design

5.1. Introduction

In this chapter a discussion based on the literature review and scoring model interview analysis will be performed. Key factors and their weightings and constraints, will be discussed. Finally, a scorecard will be developed that will contain the key factors, weightings and constraints. Taking that scorecard as input the researcher will design a system using a heuristic approach; the scheduling algorithm will be based on the decision matrix algorithm. This design will be the basis for the implementation in **Chapter 6**.

5.2. Scoring Model Discussion

This section describes the discussion of themes, key factors and weighting based on the literature review and interview analysis.

5.2.1. Themes Discussion

As discussed in the literature review, four themes were identified. Interview analysis was consistent with these themes. The following themes were concluded in this research as shown in Figure 5.1:

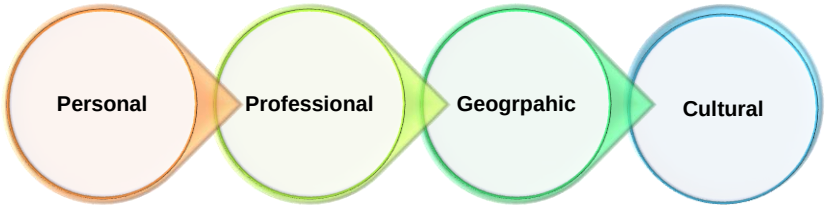

Figure 5.1. Themes identified

Factors that were related to demographics or personal traits were put in the personal factors. Factors that were deemed professional were classified under professional factors. Factors related to geographic location were categorised as geographic factors. Factors related to cultural and ethnic values were classified as cultural factors. Details of themes and factors classification sorted by theme can be found in **Appendix D**.

5.2.2. Scoring Model Factors Discussion

The literature review endorsed the key factors that play a vital role in the decision in relation to which carer to send to a client. Many important factors were identified that need to be considered when scheduling a carer. These factors have been identified in the literature review and analysed in the previous chapter. In this section the researcher has combined the outcome as shown in the Table 5.1 and this is discussed in detail in the next section:

Table 5.1. Key factors outcome based on literature review and interviews

	Theme	Factors	Literature Review	Identified as Key Factor Interview Analysis	Participants % Reported as Key Factor
			17	22	
1	Personal	Age	☑	☑	68%
2		Gender	☑	☑	74%
3		Smoking	☑	☑	71%

	Theme	Factors	Literature Review	Identified as Key Factor Interview Analysis	Participants % Reported as Key Factor
			17	22	
4		Hobbies	☑	☑	44%
5		Habits	☑	☑	53%
6		Pets		☑	53%
7		Personality		☑	56%
8		Environment		☑	49%
9	Professional	Service Needed	☑	☑	57%
10		Availability	☑	☑	67%
11		Experience	☑	☑	58%
12		Skillset	☑	☑	85%
13		Family Carer	☑	☑	58%
14		Working Hours Directive	☑	☑	33%
15		Garda Vetting		☑	67%
16		Know Carer	☑	☑	90%
17		Health and Safety		☑	33%
18	Regional	Location/Mobility	☑	☑	67%
19		Office Branch	☑	☑	33%
20		Office Group	☑	☑	33%
21	Cultural	Language	☑	☑	94%
22		Ethnicity	☑	☑	50%

Figure 5.2 shows the factors and average % of participants from all groups who considered an item to be a key factor:

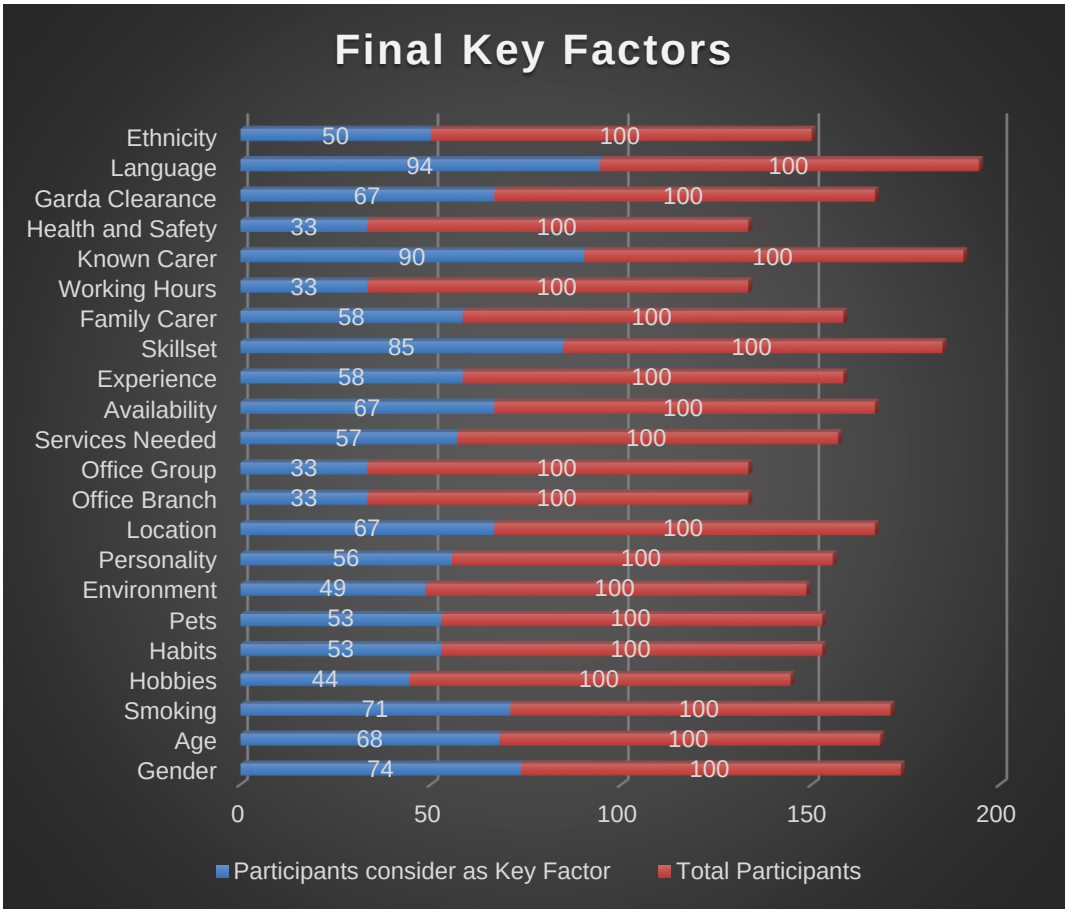

Figure 5.2. Final key factors based on discussion

The age factor was identified as a key factor in both the literature review and during the interviews. Even though it was identified as a key factor, it is not common practice for clients to request a carer in a particular age group, but some clients feel more comfortable with a particular (i.e. same as client) age group when it comes to having a carer at home. This practice was mostly noticed in younger clients. Thus, to provide quality care age needs to be considered a key factor. Similarly, with the 'gender' factor, it was not common practice for the client to have a carer of the same gender but research highlights this as a key factor. Smoking was another key factor identified during the literature review and interviews, even though in Ireland it is not permitted to smoke at a client's premises anymore. Additionally, new legislation from HSE now restricts clients smoking when a carer is working at his house. However, this factor has historical importance. Therefore, it should be considered as a key factor. According to the literature review and interviews, hobbies and habits are two factors

that can play a very positive role when scheduling carer and client. These were not specified as a hard constraint when scheduling but matching carer and client with the same habits and hobbies can act as a bonding factor. Interviews analysis indicated that clients' pets also play a key role in scheduling, due to the fact that some carers may be allergic. It is important that this factor is matched with a carer's preferences before scheduling a carer. Interview analysis indicated a client's environment as another important factor. There was not much emphasis on this in the literature review but care managers and carers consider this a major factor and sometimes a carer may have concerns before going to a client's home, because the client's environment may not be healthy for a carer, so this is another important factor that needs to be considered when scheduling a carer. Personality was also identified as a key factor during interviews. There was not much emphasis on this in the literature review, but care managers consider this an important factor when scheduling to ensure the best match for a quality service.

When domiciliary care providers receive a new client, a client's needs assessment is performed, which determine the kind of services and skill set required (see **Appendix B** for types of service required). Based on the services and skillset required an appropriate carer is chosen. Services needed and skillset are key factors in ensuring the quality of care. Along with skillset and services needed, another important factor identified was the working experience of the carer. Due to the nature of domiciliary care, it was considered an important factor for high dependency clients. Some clients may need only help with cooking, washing or cleaning, while others may need help with reablement, which can be more complicated and require more experienced and skilled carers. A family carer is another factor identified during the literature review and interview analysis. Sometimes due to the nature of a client, a family carer might be required; for example, if a child under 18 year of age had a disability and required care, his or her mother or father could be the preferred carer, or sometimes a client may have a carer in the family that he would prefer.

As discussed in the literature review, there is a huge amount of family carers in the U.S., so this acts as an important factor. The known carer was another factor reported during interviews and found in the literature review. Known care means a carer has already been introduced to the client. Clients normally prefer a known carer as they are aware of a client's needs and routines. Health and safety was also a major concern of carers and care managers when scheduling. As discussed in the interview analysis a client may have learning disabilities or dementia or an infectious disease or violent behaviour that could pose a danger to a carer's health and safety. Health and safety requires special

consideration when scheduling a carer. The literature review and interview analysis indicates that location and mobility are very important factors for carer scheduling. In order to ensure that carers focus more on work and less on travelling, they need to be intelligently scheduled. Language is also an important factor: when client and carer speak the same language, it can remove any communication barriers and improve the quality of care. Ethnicity was another factor identified which needs to be considered when scheduling carers in some cases; however, interview analysis indicated ethnic preferences only existed in elderly clients. Availability is also an important factor; a carer must be available before she/he can schedule. A carer may not be available for the time the visit is required, or she/he may be busy with another client. Also, when scheduling carers, a care manager needs to take travel time into account; for example, a carer cannot be scheduled for two consecutive visits if there is significant travel time between the two locations. The working time directive and Garda vetting are legislative requirements in Ireland. A carer can't work more than 48 hours a week, and Garda vetting of a carer is required to ensure client safety. These two factors need to be ensured before scheduling a carer.

Office branch and office groups are two factors linked to the geographic administration; interview analysis indicates that when care providers operate in branches, a carer from one branch may or may not be able to work for another branch. Similarly, in branches there can be subcategories based on the area: some carers may work in one particular area and others in a different area. Sometimes they may have fixed geographic areas where they work whilst at other times, they can be flexible. Table 5.2 shows a final list of factors based on the literature review, interview analysis and discussion:

Table 5.2. Final list of key factors

Factors			Final Key Factor Based on Discussion (Literature Review + Interview Analysis)
1	Personal	Gender	☑
2		Age	☑
3		Smoking	☑
4		Hobbies	☑
5		Habits	☑

Factors			Final Key Factor Based on Discussion (Literature Review + Interview Analysis)
6		Pets	☑
7		Personality	☑
8		Environment	☑
9	Professional	Service Needed	
10	Professional	Availability	☑
11	Professional	Experience	☑
12	Professional	Skillset	☑
13	Professional	Family Carer	☑
14	Professional	Working Hours Directive	☑
15	Professional	Garda Vetting	☑
16	Professional	Know Carer	☑
17	Professional	Health and Safety	☑
18	Regional	Location/Mobility	☑
19	Regional	Office Branch	☑
20	Regional	Office Group	☑
21	Cultural	Language	☑
22	Cultural	Ethnicity	☑

5.2.3. Scoring Model Weighting Discussion

As discussed in the literature review, there was not much found in relation to the weighting of key factors. However, during the interviews weighting information was gathered. Table 5.3 shows the outcome of weighting. For each factor weighting was gathered from 1-5 from each user group. The average of the outcome was then treated as the final score.

Table 5.3. Final list of weighting based on interviews and discussion

	Theme	Factors	Final Avg. Weighting Based on Discussion
1	Personal	Gender	3.08
2		Age	3.14
3		Smoking	2.71
4		Hobbies	1.83
5		Habits	2.08
6		Pet	2.10
7		Environment	2.81
8		Personality	2.28
9	Professional	Service Needed	2.72
10		Availability	3.44
11		Experience	3.08
12		Skillset	3.83
13		Family Carer	3.00
14		Working Time Directive	2.33
15		Garda Vetting	3.68
16		Know Carer	4.06
18		Health and Safety	2.33
19	Regional	Location/Mobility	2.90
20		Office Branch	2.33
21		Office Group	2.00
22	Cultural	Language	3.94
23		Ethnicity	1.92

Figure 5.3 shows the final weighting based on the discussion:

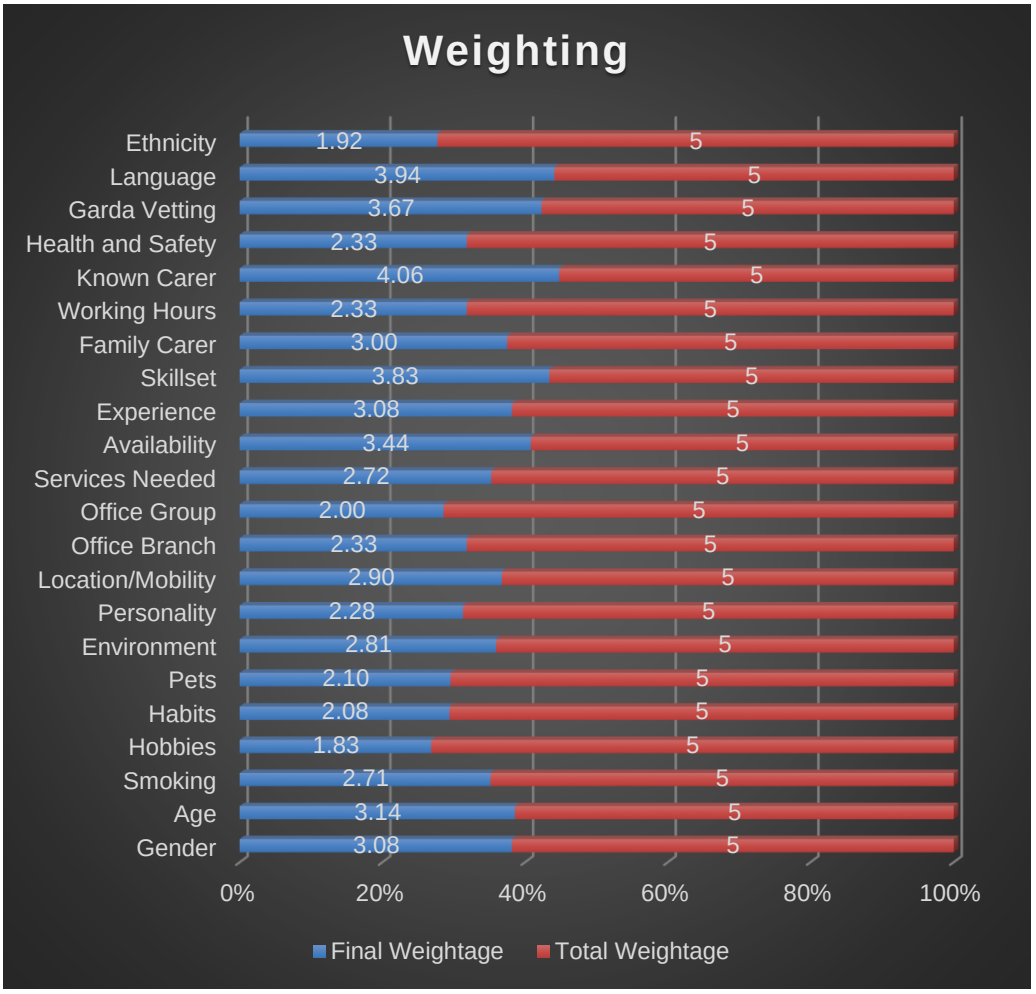

Figure 5.3. Final weighting based on the interviews and discussion

5.2.4. Factors Matching Hard Constraints Discussion

The literature review indicates that availability and working hours are hard constraints. These findings were consistent with the interview analysis. During the interviews, Garda clearance was also identified as a requirement before a carer is sent to a client's house. However, this may not be required if a carer is a family carer.

Table 5.4. Final list of hard constraints based on discussion

	Theme	Factors	Hard Constraints
1	Professional	Availability	☑
2	Professional	Working Hour Time Directive	☑
3	Professional	Garda Clearance	☑

5.2.5. Scorecard - Factors and Weighting Correlation

Key factors and weighting were discussed and finalised in the previous sections. In this section, the final scorecard is examined. Based on this card, a system was designed and developed to test this. Table 5.5 shows key factors and their weighting.

Table 5.5. Final Scorecard - list of key factors, weighting and constraints

	Theme	Final Key Factor Based on Discussion (Literature Review + Interview Analysis)	Final Avg. Weighting Based on Discussion	Hard Constraint
1	Personal	Gender	3.08	
2		Age	3.14	
3		Smoking	2.71	
4		Hobbies	1.83	
5		Habits	2.08	
6		Pet	2.10	
7		Environment	2.81	

	Theme	Final Key Factor Based on Discussion (Literature Review + Interview Analysis)	Final Avg. Weighting Based on Discussion	Hard Constraint
8		Personality	2.28	
9	Professional	Service Needed	2.72	
10		Availability	3.44	☑
11		Experience	3.08	
12		Skillset	3.83	
13		Family Carer	3.00	
14		Working Time Directive	2.33	☑
15		Garda Vetting	3.67	☑
16		Know Carer	4.06	
17		Health and Safety	2.33	
18	Regional	Location/Mobility	2.90	
19		Office Branch	2.33	
20		Office Group	2.00	
21	Cultural	Language	3.94	
22		Ethnicity	1.92	

5.3. Scoring Model Design

As discussed in the previous section, a scorecard was developed. This scorecard was the basis used to design the scoring model system to help care managers in scheduling decision making. In this section, the design of the system is discussed.

5.4. Scoring Model Data Structure Design

In order to design a system based on the scorecard, first data structures need to be established. These data structures are used to design the database. Archetypes are used to simplify the illustration of the information that needs to be captured. Tables are included as well to show the depth of information that needs to be captured. Furthermore, an algorithm is designed to find the best-suited carer based on the parameters (key factors and their weighting) provided.

In this section data structures for the scoring model are designed. In order to process information, it is important that information is properly structured. Archetype and table will be used to explain the data structure of the system design. Correlation of concluded factors and data structure can be found in the following **Section 5.5**.

There were two types of data structures created: primary data structures (for example carer, client and task data structures) and secondary data structures (for example services, skill set, hobbies, habits, age group, health and safety, language and personality). The purpose of secondary data structures was to support the primary data structure; for example a client may need more than one service, and all the services can be populated in the service data structure and their comma separated IDs can be used by the primary data structure. Additional relationship data structures can be created but, to keep the design simple, the researcher decided to use comma separated values (CSV).

Figure 5.4 shows the archetype and Table 5.6 shows the names of all the data structures created to support the design of the scoring model. Data structures marked as **(P)** are primary and data structures marked as **(S)** are secondary:

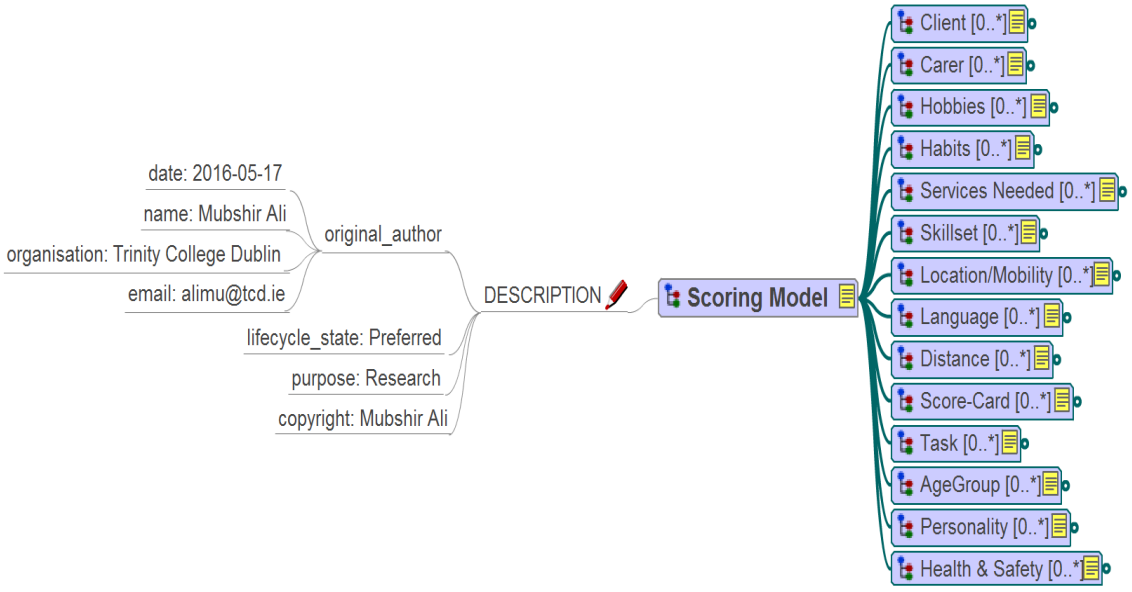

Figure 5.4. Scoring model archetypes

Table 5.6. Explanation of each archetype and intended usage

	Archetype	Factors Linked	Details
1.	Services **(S)**	Service needed	Manage service needed information list, as client may prefer multiple services
2.	Skillset **(S)**	Skill set	Manage skillset list, as client, may require multiple skillsets
3.	Languages **(S)**	Language	Manage languages list, as client may prefer multiple options
4.	Hobbies **(S)**	Hobbies	Manage hobbies list, as client may prefer multiple options
5.	Age Group **(S)**	Age	Manage age groups, as multiple age groups are required
6.	Habits **(S)**	Habits	Manage habits list, as client may prefer multiple options

7.	Mobility **(S)**	Location / Mobility	Manage locations list, as carers may have multiple mobility options
8.	Personality **(S)**	Personality	Manage personalities list, as client may prefer multiple options
9.	Health and Safety **(S)**	Health and safety + Environment + Pets	Manage health and safety list as multiple options may be applicable
10.	Carer **(P)**	All carer related factors (see Carer data structure / archetype for details)	Manage carer list and preferences data
11.	Client **(P)**	All client related factors (see Client data structure / archetype for details)	Manage client list and preferences
12.	Tasks **(P)**	Task related data	Manage task data
13.	Scorecard **(P)**	Scorecard contains factors , weighting and constraints	Manage scorecard data: this table can be used as master table to manage configurations

5.4.1. Carer Data Structure

Figure 5.5 shows the archetype and Table 5.7 shows the design of carer data structure, attributes and key factors linked:

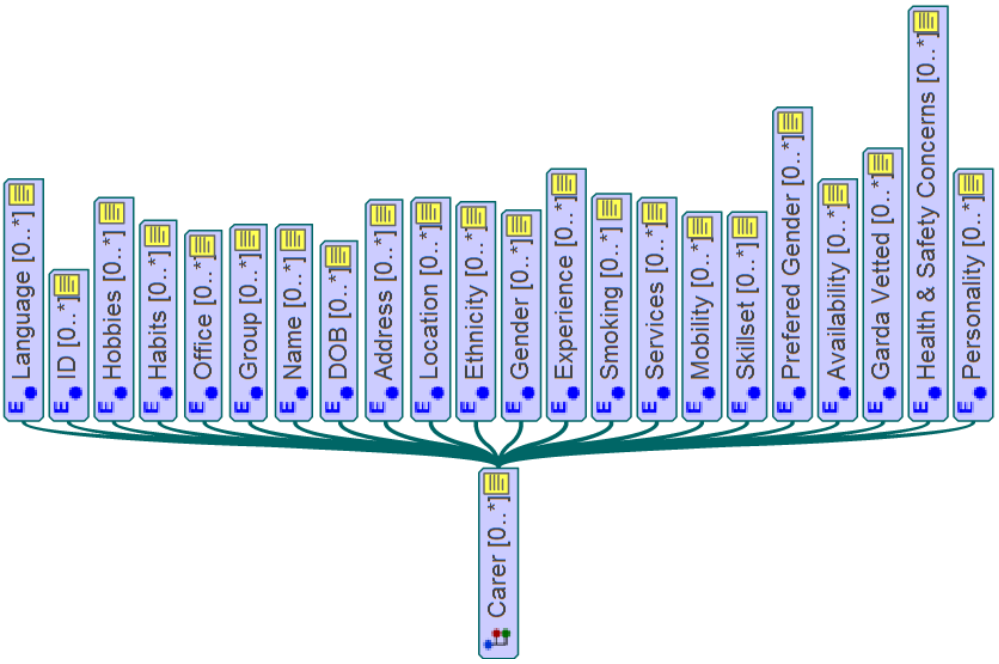

Figure 5.5. Carer archetype

Table 5.7. Carer data structure

ID	Attribute	Description	Key Factor Linked
1	ID	Unique identification number of each record	
2	Branch	Office branch of carer	Office Branch
3	Group	Group of carer	Office Group
4	Name	Name of carer	NA
5	DOB	Date of birth	Age
6	Location	Location coordinates of carer	Location
7	Ethnicity	Ethnicity of carer	Ethnicity
8	Gender	Gender of carer	NA
9	Experience	Working experience of carer in years	Experience
10	Smoking	Carer is smoker or non-smoker	Smoking
11	Services	What services carer can provide	Service Needed

Table 5.7. Carer data structure			
ID	**Attribute**	**Description**	**Key Factor Linked**
12	Mobility	What kind of mobility carer has	Mobility
13	Skillset	What skillset carer has	Skillset
14	Hobbies	What kind of hobbies carer has	Hobbies
15	Language	Languages that carer can speak	Language
16	Habits	Habits of the carer	Habits
17	Preferred Gender	Preferred Gender of person to provide care	Gender
18	Availability	Availability of the carer	Availability
19	Garda Vetted	Has carer been Garda vetted	Garda Vetted
20	Personality	Personality of carer	Personality
21	Health & Safety Concerns	Health and safety concern of carer	Health and Safety + Environment + Pets

5.4.2. Client Data Structure

Figure 5.6 shows the archetype and Table 5.8 shows the design of client data structure, attributes and key factors linked:

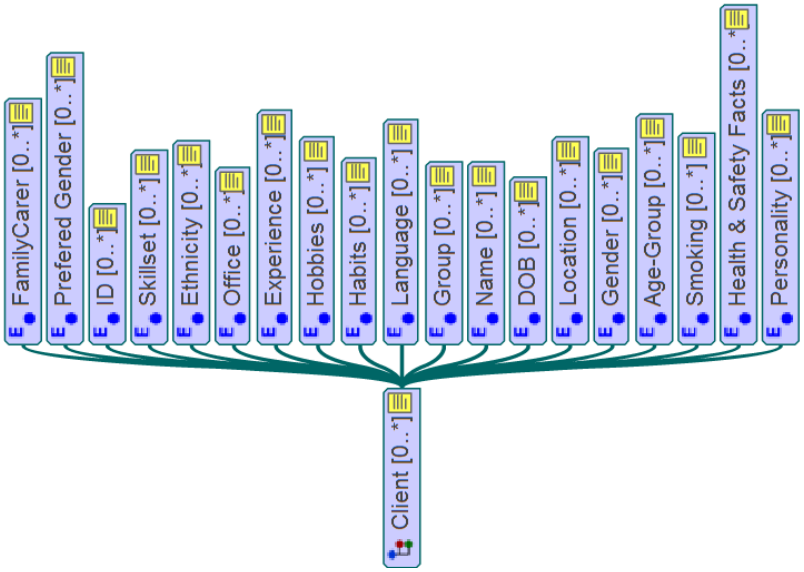

Figure 5.6. Client archetype

Table 5.8. Client data structure			
ID	**Attribute**	**Description**	**Key Factors Linked**
1	ID	Unique identification number of each record	
2	Branch	Office branch of client	Office Branch
3	Group	Client group	Office Group
4	Name	Client name	NA
5	DOB	Date of birth	NA
6	Location	Client home geolocation	Location
7	Ethnicity	Client ethnicity	Ethnicity
8	Gender	Gender of client	NA
9	Age Group	What age group carer should be in	Age Group
10	Smoking	Client is smoker or non-smoker	Smoking
11	Skillset	What skillset carer should have	Skillset
12	Hobbies	Client hobbies	Hobbies
13	Language	Languages that client prefer	Language
14	Habits	Habits of the client	Habits
15	Preferred Gender	Preferred gender of carer	Gender
16	Family Carer	List of family carers	Family Carer
17	Personality	Personality of client	Personality
18	Health & Safety Facts	List of health and safety related items that are linked with client	Health and Safety + Environment + Pets

5.4.3. Services Data Structure

Figure 5.7 shows the archetype and Table 5.9 shows the design of service data structure, attributes, key factors linked and weighting:

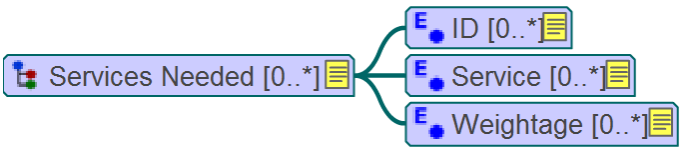

Figure 5.7. Services archetype

Table 5.9. Service data structure			
ID	**Attribute**	**Description**	**Linked Factors and Weighting**
1	ID	Unique identification number of each record	NA
2	Service	Name of service	Services Needed
3	Weight	The weight of service: to make the system more configurable a weight can be given to each service. For the purposes of this research paper, the weighting identified during the literature review was used for all the services and all other factors.	Weighting of Service Needed

5.4.4. Skill set Data Structure

Figure 5.8 shows the archetype and Table 5.10 shows the design of skill set data structure, attributes, and key factors linked and weighting:

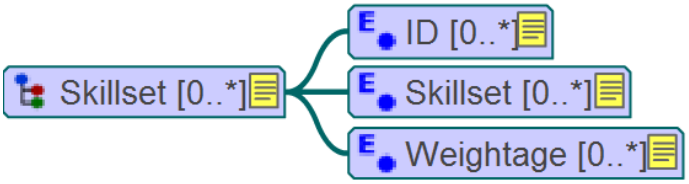

Figure 5.8. Skill set archetype

Table 5.10. Skillset data structure			
ID	**Attribute**	**Description**	**Linked Factors and Weighting**
1	ID	Unique identification number of each record	NA
2	Skillset	Skill set of carer	Skillset
3	Weight	The weight of skillset.	Weighting of Skillset

5.4.5. Language Data Structure

Figure 5.9 shows the archetype and Table 5.11 shows the design of language data structure, attributes, key factors linked and weighting:

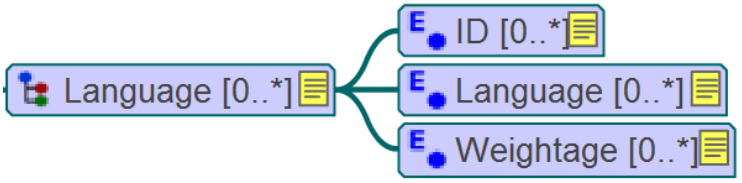

Figure 5.9. Language archetype

Table 5.11. Language data structure

ID	Attribute	Description	Linked Factors and Weighting
1	ID	Unique identification number of each record	NA
2	Languages	Available Languages	Languages
3	Weight	The weight of language.	Weighting of Language

5.4.6. Hobbies Data Structure

Figure 5.10 shows the archetype and Table 5.12 shows the design of hobbies data structure, attributes, key factors linked and weighting:

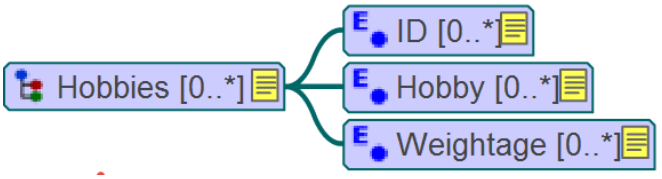

Figure 5.10. Hobbies archetype

Table 5.12. Hobbies data structure			
ID	**Attribute**	**Description**	**Linked Factors and Weighting**
1	ID	Unique identification number of each record	NA
2	Hobbies	Available of Hobbies	Hobbies
3	Weight	The weight of each hobby; to make system more configurable weight to each hobby can be given. For the purposes of this research paper, weighting identified during the literature review was used for all hobbies.	Weighting of each Hobby

5.4.7. Age Group Data Structure

Figure 5.11 shows the archetype and Table 5.13 shows the design of age group data structure, attributes, key factors linked and weighting:

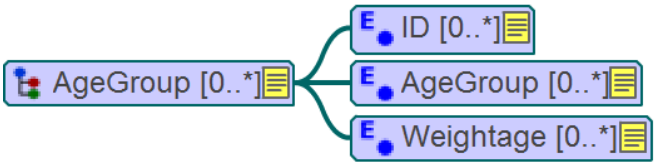

Figure 5.11. Age group archetype

Table 5.13. Age Group data structure			
ID	**Attribute**	**Description**	**Linked Factors and Weighting**
1	ID	Unique identification number of each record	NA
2	Age Group	Available age groups	Age Group
3	Weight	Weight of age group	Weighting of age group

5.4.8. Habits Data Structure

Figure 5.12 shows the archetype and Table 5.14 shows the design of Habits data structure, attributes, key factors linked and weighting:

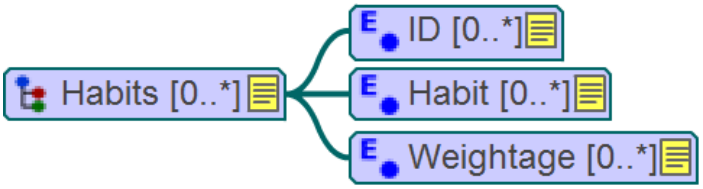

Figure 5.12. Habits archetype

Table 5.14. Habit data structure

ID	Attribute	Description	Linked Factors and Weighting
1	ID	Unique identification number of each record	NA
2	Habits	Available Habits	Habits
3	Weight	Weight of habit	Weighting of Habit

5.4.9. Location/Mobility Data Structure

Figure 5.13 shows the archetype and Table 5.15 shows the design of location/mobility data structure, attributes, key factors linked and weighting:

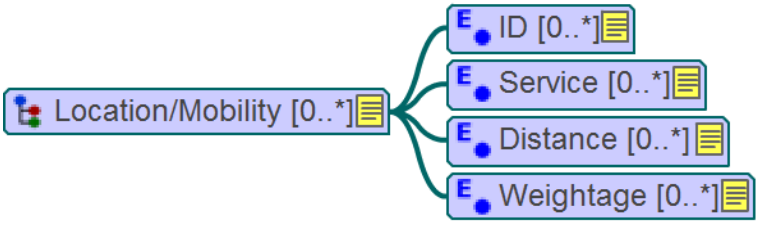

Figure 5.13. Location/mobility archetype

Table 5.15. Mobility data structure			
ID	**Attribute**	**Description**	**Linked Factors and Weighting**
1	ID	Unique identification number of each record	NA
	Mobility	Carer mobility for example bike, car	Mobility
2	Distance	Distance carer can cover for example 5 KM, 10 KM	Location
3	Weight	Weight of mobility and distance	Weighting of distance

5.4.10. Personality Data Structure

Figure 5.14 shows the archetype and Table 5.16 shows the design of personality data structure, attributes, key factors linked and weighting:

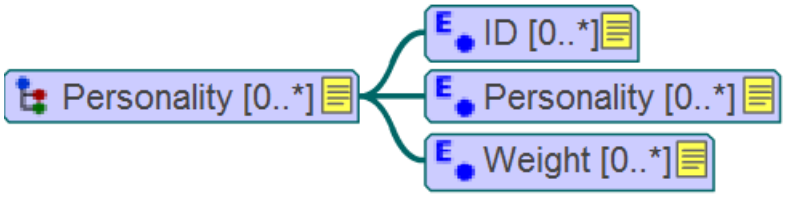

Figure 5.14. Personality archetype

Table 5.16. Personality data structure			
ID	**Attribute**	**Description**	**Linked Factors and Weighting**
1	ID	Unique identification number of each record	NA
2	Personality	Carer personality	Personality
3	Weight	Weight of service	Weight of service

5.4.11. Health and Safety Data Structure

Figure 5.15 shows the archetype and Table 5.17 shows the design of health and safety data structure, attributes, key factors linked and weighting:

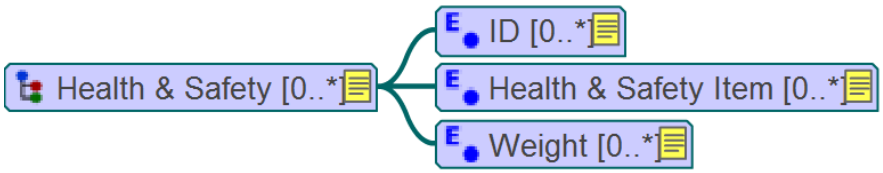

Figure 5.15. Health and safety archetype

Table 5.17. Health and safety data structure			
ID	**Attribute**	**Description**	**Linked Factors and Weighting**
1	ID	Unique identification number of each record	NA
2	Health & Safety Item	Health and safety items. For example Client has dogs	Health and safety
3	Weight	Weight of health and safety item	Weight of health and safety

5.4.12. Task Data Structure

Figure 5.16 shows the archetype and Table 5.18 shows the design of task data structure, attributes and key factors linked:

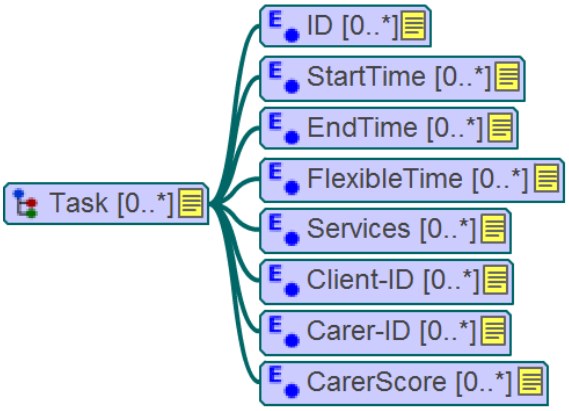

Figure 5.16. Task archetype

Table 5.18. Task data structure			
ID	**Attribute**	**Description**	**Linked Factors and Weighting**
1	ID	Unique identification number of each record	NA
	Start Time	Task start time	Availability
2	End Time	Task end time	Availability
3	Flexible Time	Is this task time flexible	NA
4	Services	Service required for this task	Services Needed
5	Client	Client linked with this	NA
6	Carer	Carer to whom task is assigned	NA
7	Carer Score	How many scores did carer get	Weighting

5.4.13. Scorecard Data Structure

Figure 5.17 shows the archetype and Table 5.19 shows the design of scorecard data structure, attributes and key factors linked:

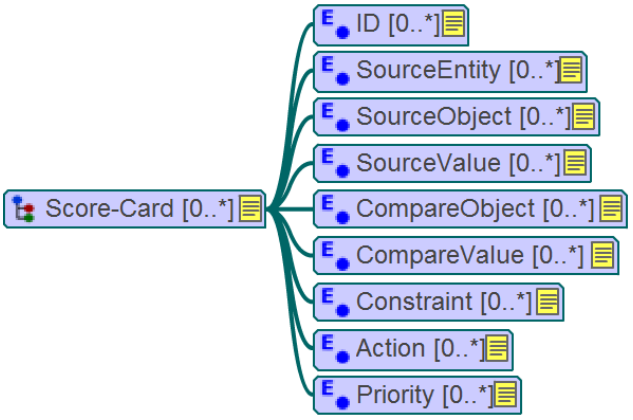

Figure 5.17. Scorecard archetype

Table 5.19. Scorecard data structure		
ID	**Attribute**	**Description**
1	ID	Unique identification number of each record
2	Source Entity	Entity that needs to be compared
3	Source Attribute	Attribute of source entity
	Compare Value	The source attribute value that needs to be compared.

Table 5.19. Scorecard data structure		
ID	**Attribute**	**Description**
4	Constraints	Is it a soft or hard constraint
5	Weighting	Avg. weighting identified based on discussions

Further explanation of the Scorecard data structure:

1. Source Entity

The is the source entiry that needs to be matched. For example, if you are scheduling a carer and client, and client requires English speaking carer. In this case, the source entity is 'Client'.

2. Source Attribute (Linked with the key factors)

This is the source factor that needs to be compared. For example, when comparing a client's language with a carer's language, Client 'Language' is the source factor.

3. Carer Compare Attribute (Linked with the key factors)

The compare entity is the entity that will be matched with the source entity mentioned in the above example. For example, when scheduling a carer and client, and carer should be English speaker. In this case, the compare attribute is Care's 'Language'.

4. Constraints (Hard or soft)

As discussed above in detail, constraints are set to ensure that hard constraints, also called hard logic, can be satisfied. Hard logic is a dependency that has to be satisfied. Whereas soft constraints or soft logic is discretionary. For example Garda vetting is a hard constraint.

5. Weighting of Factor Linked

This is the weighting of the factor identified during the discussions. Normally based on the matched factors, appropriate weighting specified in this column will be applied, but for the secondary tables this weighting will be multiplied with the sum of the secondary table weighting. For example, if carer and client are non-smoking weighting is 2.71; this will be simply added to a carer's total score. If the attribute can have more than one value (in case of secondary tables), for example a client and carer can have many matching hobbies, then in this case the sum of all matches will be multiplied with the weighting and added to a carer's score. If client and carer match three hobbies, three will be multiplied by 1.83 (hobby factor weighting) equal to 5.49 and this will be added to a carer's total score.

Table 5.20 Final scorecard design

SCORECARD					
ID	Source Structure	Source Attribute (Factor)	Carer Compare Attribute (Factor)	Constraint Type	Weighting of Factor Linked
1	Client	Office	Office	Soft	2.33
2	Client	Group	Group	Soft	2.0
3	Task	Start. Time + End. Time	Availability	Hard	3.44
4	Task	Duration	Worked Hours	Hard	2.33
5	Client	Location	Location	Soft	2.90
6	Task	Service	Service	Soft	2.72
7	Client	Language	Language	Soft	3.94
8	Client	Hobbies	Hobbies	Soft	1.83
9	Client	Habits	Habits	Soft	2.08
10	Client	Smoking	Smoking	Soft	2.71
11	Client	Gender	Gender	Soft	3.08
12	Client	Experience	Experience	Soft	3.08
13	Client	Family Carer	Family Carer	Soft	3.0
14	Client	Know Carer	Known Carer	Soft	4.06
15	Client	Skillset	Skillset	Soft	3.83
16	Client	Preferred Age Group	Age	Soft	3.14
17	NA	NA	Garda Vetted	Hard	3.66
18	Client	Personality	Personality	Soft	2.28
19	Client	Health and Safety	Health and Safety Concern	Soft	2.33
20	Client	Ethnicity	Carer	Soft	1.92

5.5. Correlation Scorecard Vs Data Structure

There were total 22 factors identified during discussion based on the literature review and scoring model analysis. As discussed above, during designing the scoring model these 22 factors were amalgamated into 20 factors; The output of the algorithm was not affected but this made design simple. Table 5.21 shows the association between scorecard factors and scoring model factors:

Table 5.21 Scorecard and scoring model correlations

Final Scorecard Factor		Scoring Model Design Factor	
1	Gender	1	Gender
2	Age	2	Age
3	Smoking	3	Smoking
4	Hobbies	4	Hobbies
5	Habits	5	Habits
6	Personality	6	Personality
7	Service Needed	7	Services Needed
8	Availability	8	Availability
9	Experience	9	Experience
10	Skillset	10	Skillset
11	Family Carer	11	Family Care
12	Working Time Directive	12	Working Time Directive
13	Garda Vetting	13	Garda Vetting
14	Know Carer	14	Known Carer
15	Location/Mobility	15	Locaiton /Mobility
16	Office Branch	16	Office Branch
17	Office Group	17	Office Group
18	Language	18	Language
19	Ethnicity	19	Ethnicity
20	Pet →	20	→ Health and Safety
21	Environment →		
22	Health and Safety →		

5.6. Scoring Model Algorithm Design

During the literature review, various algorithms were identified. The researcher decided to use the ‘Decision Matrix’ due to its relevance to the current problem. According to Yang, a decision matrix assesses and organises a rundown of choices. The group first builds up a rundown of weighted criteria and after that assesses every alternative against those criteria. A decision matrix is used when a list of options must be narrowed down to one choice. Similarly, a decision must be made on the basis of several criteria after the list of options has been reduced to a manageable number by list reduction (Yang, 1994).

This section describes the development of the heuristic algorithm to identify the best-suited carer for a required task. The approach uses a ‘Decision Matrix’ technique to determine the best-suited carer. The algorithm will work based on the data structure and scorecard defined in the previous section.

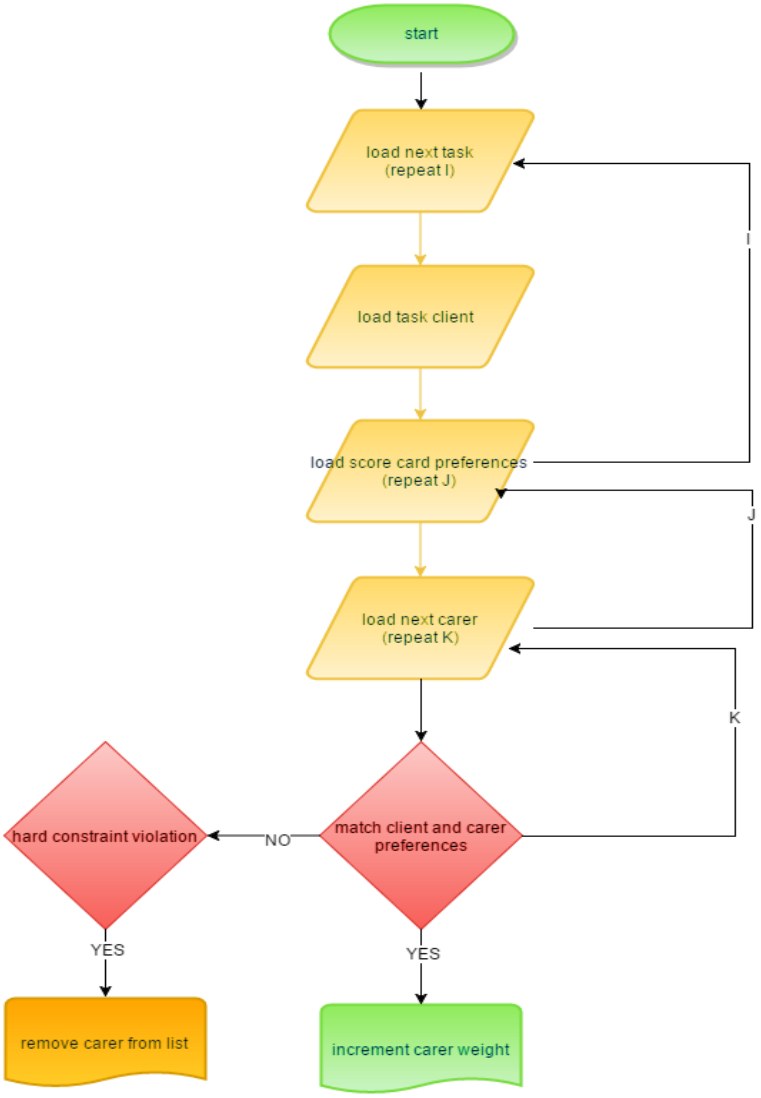

Figure 5.18. Algorithm data flow diagram

```
                    ********************
                    * Algorithm Design *
                    ********************

Note: Green text show comments in the algorithm.

Step 1: Load all tasks that need to be scheduled. Define
variable TL, which will contain the list of all tasks.
var TL := List of all task
```

```
Step 2: Loop through each task one by one, define var Ti,
which gives current active tasks that needs to be scheduled.
For var Ti = TL.Next Task

Step 3: Get client associated with task Ti. Define a variable
Cj, which contains the client associated with task Ti.

var Cj = TLi.Client

Step 4: Load scorecard with all the preferences defined. Loop
through each preference one by one. First, define scorecard
variable SC, then define another variable SCk to loop through
each preference one by one.
var SC = List of all preferences
For var SCk = SC.Next Scorecard Preference

Step 5: Load all carers and loop through each carer and
compare current preference selected. Define the variable CL
that will contain the list of all carer; CLl is current carer
that needs to be cross checked with client Cj in task Ti.
var CL = Load Carer List
var CLl = CL.Next Carer

Step 6: Match client and carer preferences as per scorecard.
if(SCk.Cj.Prefernce == SCk.CLl.Prefernce)
CLi.Score = Add Weight
else if(SCk.Contraint == 'Hard' AND SCk.Contraint ==
'Client')
CLi.Remove From CL

Step 7: Repeat step 5 to match the next carer, until all
carers have been matched with the current preference to get
weight.
Repeat step 6
```

```
Step 8: Repeat step 4 to match next preference, until all the
preferences have been matched to get the best suited carer
among all the available carers.
Repeat step 5

Step 9: Assign the current task Ti, a carer with the highest
score.
Assign Ti = CLi.HighestScore

Step 10: Repeat step 2 to find a suitable carer for next
task, until all the tasks have been matched to get the best-
suited carer among all the available carers.
Repeat step 2
```

5.7. Conclusion

The literature review and interview analysis and discussions determined the key factors, weightings and constraints. Based on discussions, a scorecard was designed. Using key factors, weightings, constraints and scorecard, the scoring model system was designed using a heuristic approach. An algorithm was developed to identify a suitable carer based on the data structure defined. In the next chapter, this design is tested by implementing the design in a computer-based program.

Chapter 6

System Implementation

6.1. Introduction

This chapter discusses the implementation of the scoring model; which programming language was used for coding; and which database was used to store the data. Interfaces of the program, sample data used and results of the evaluation are discussed in detail.

6.2. Implementation of Scoring Model

In this section data structures and the algorithm from previous chapter were implemented to evaluate the results. To test the scoring model, there were various technologies available, such as Java, .Net, SQL Server. However, due to simplicity and ease of access, Microsoft Visual Basic Application was used, and Microsoft Access was used as the database. The rationale of this was to make implementation accessible to anyone with MS Office, while ensuring the ability to collate the source files of the database, source code and program itself in a single file.

6.2.1. Database Implementation

The database was implemented using Microsoft Access; implementation was based on the data structure design discussed in the previous chapter. This section provides details on the implementation of the design of the data structures that was developed in MS Access.

Database implementation of all the tables is available in **Appendix J**. Table 6.1 shows the implementation of carer data structure in MS Access:

Table 6.1 Carer data table implementation in MS Access

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each carer
Office	Short Text	Office name to which carer belongs
Group	Short Text	Group name to which carer belongs
Name	Short Text	Name of carer
DOB	Date/Time	Date of birth of carer
Address	Date/Time	Address of carer
Location	Short Text	Location of carer
Ethnicity	Short Text	Ethnicity of carer
Gender	Short Text	Gender of carer
Experience	Number	Working experience of carer in years
Smoking	Number	Is carer smoking or non-smoking
Services	Short Text	Service carer can provide
Mobility	Number	Mobility of carer, how far carer can travel, for example car, bus or bike
Skillset	Short Text	Skill set carer has
Hobbies	Short Text	Hobbies of carer
Language	Short Text	Languages carer can speak
Habits	Short Text	Habits of carer
PreferedGender	Short Text	Preferred gender of carer
Availability	Short Text	Availability of carer
PreferredPersonality	Short Text	Personality of carer
GardaVetted	Date/Time	Garda vetting date
HealthSafetyConcerns	Short Text	Health & Safety Concerns

6.2.2. Entity Relationship Diagram

Figure 6.1 shows the entity relation diagram (ERD) of the system database:

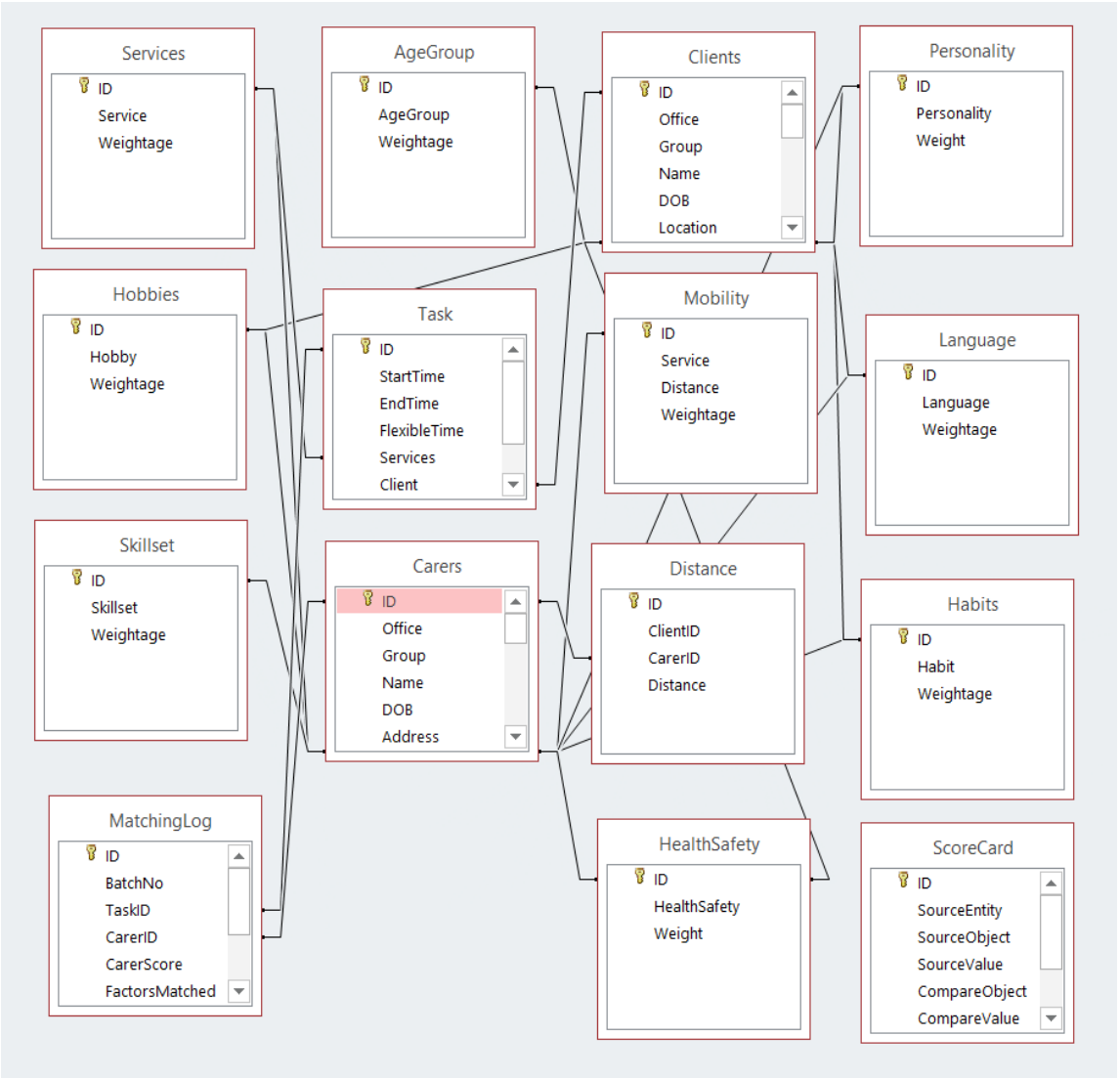

Figure 6.1 Entity relationship diagram

6.2.3. User Interface Implementation

To make implementation easy to access and interaction with the database friendlier, forms (interfaces) were designed. While implementing the design Don Norman 7 principles, as shown in **Appendix G**, were considered and integrated into the design as best as possible.

For example, Figure 6.2 shows the interface aimed to manage the carer. Users could view, update and search existing carers from the database in this screen. This screen also allows the addition of a new record:

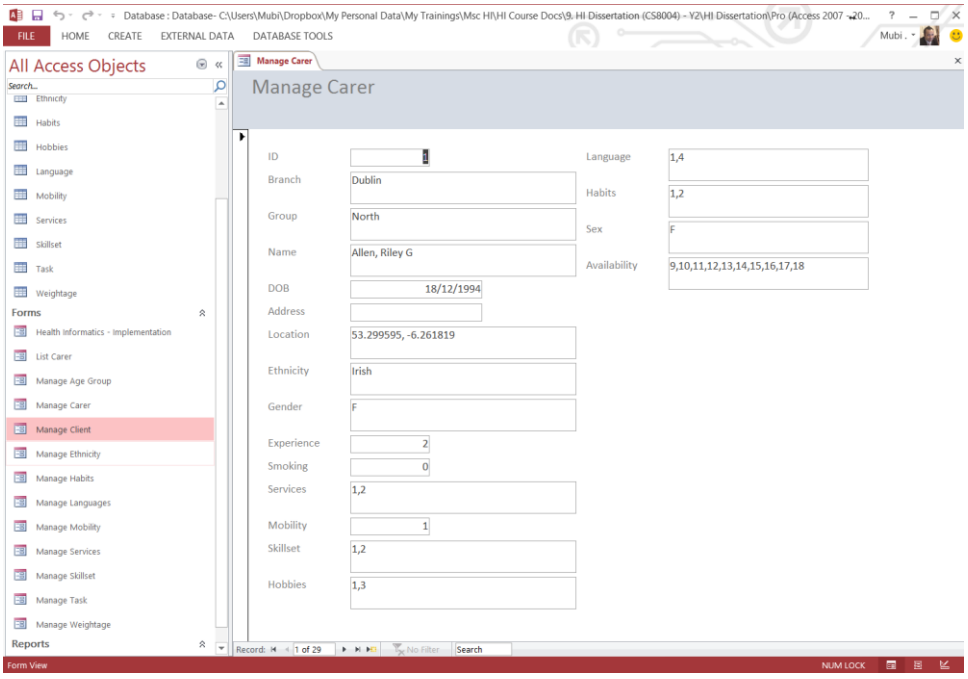

Figure 6.2. Manage carer interface

Figure 6.3 shows interface that was designed to manage the client. Users could view, update and search existing carers from the database in this screen. This screen also allows adding a new record.

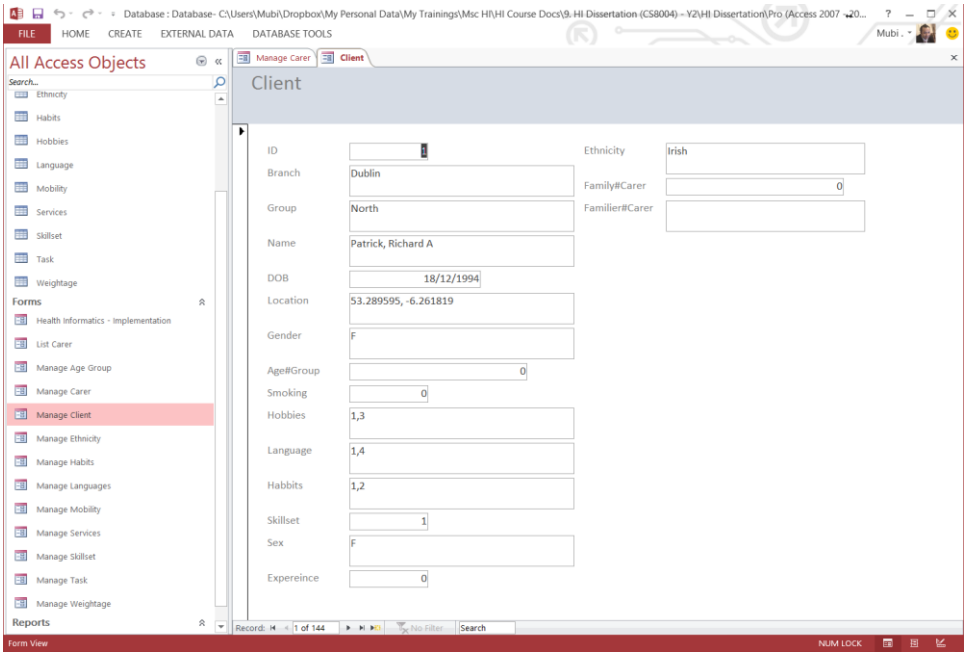

Figure 6.3. Manage client interface

6.2.4. Algorithm Code Implementation

The algorithm was implemented using Visual Basic Application. The following are some facts of implementation:

Implementation Facts:

1. 20 factors were implemented based on the final scoringcard design as discussed in the previous table
2. All carers were marked as Garda vetted
3. The program only deals with valid data; there is no exception handling at this stage
4. Sample data needs to be carefully added; **Appendix K** shows data that is currently populated in the system for testing purpose
5. Sample data values were tweaked to get different results
6. While matching the factors, if there was constraint violation, the system subtracted the 100 score from carer rather than removing it from the list, so that carer still appeared in the list but with a negative score
7. For secondary structures (see **Table 5.6** for secondary tables) users were able to add the weighting for each item. If there is more than one matching value, the system took the sum of all values and then multiplied by the factor weighting. For

example, if three skill sets required by client matched with the carer, the system will took the sum of three, which is three (because default weighting in the secondary tables sample data is 1, see **Appendix K.8**); the system will then multiply three by the weighting of skill set, which is 3.83 ,to get the total score. Secondary tables also allowed the users to tweak the weighting of each item if needed.

6.3. Program Evaluation

This section outlines how to download, run the program, populate data and evaluate the results based on the data. Source code files, databases along with sample data, can be downloaded from the following link, using Microsoft Access 2007 or higher to run this program:

App Download Link:
https://www.dropbox.com/s/3uf5jbhv19b2qu4/App.accdb?dl=0

App Demo Video Link:
https://www.dropbox.com/s/v5r9dj7ubgt4zvs/Demo.mp4?dl=0

6.3.1. Understanding the Program

As discussed above, this program is implemented in MS Access. The program can be downloaded from the link provided in the previous section. The program can be downloaded as a single file with the name *App.accdb*. The program can be started by clicking on the file icon as shown below:

Figure 6.4 shows main interface of the program, the icons numbered and highlighted in red are explained below:

1. The user can click here to start carer and client allocation process.
2. Database tables of the system
3. User form to input, view and edit data
4. Sample reports that can be generated from system
5. Source code containing the Visual Basic script

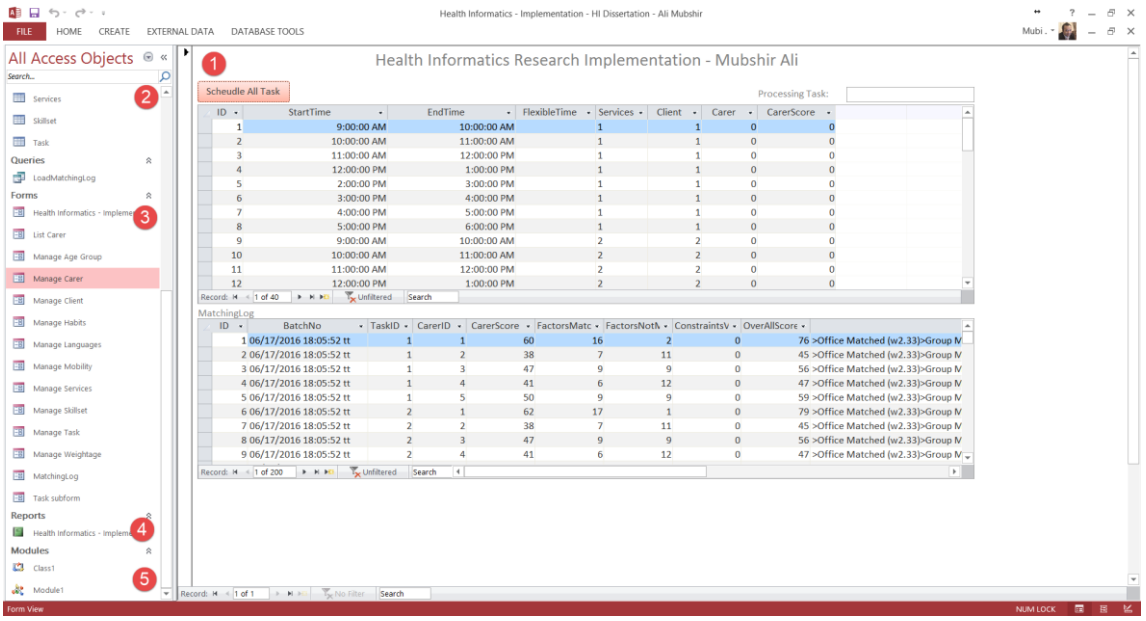

Figure 6.4 Program Overview

6.3.2. Populating Sample Data

This section describes the data that was populated in the data tables to evaluate the algorithm and design of the system. Sample data was randomly added for the quantitative analysis of the program, data was kept as realistic possible but with simulated carer and client names. Details of each data table and what data was populated is available in **Appendix K**.

Table 6.2 show the sample data population in the carer table; some columns have been intentionally removed:

Table 6.2 Carer sample data

Carer data table																	
ID	**Office**	**Group**	**Name**	**Ethnicity**	**Gender**	**Experience**	**Smoking**	**Services**	**Mobility**	**Skillset**	**Hobbies**	**Language**	**Habits**	**Preferred Gender**	**Availability**	**Preferred Personality**	**Garda Vetted**	**Health Safety Concerns**
1	Dublin	North	Carer	Irish	M	1	1	1	3	1	1	1	1	M	9,10,11,12,13,14,15,16,17,18	1		5
2	Dublin	North	Carer	British	F	2	0	2	3	2	2	2	2	F	9,10,11,12,13,14,15,16,17,18	2		4
3	Dublin	North	Carer	Germ	M	3	1	3	3	3	3	3	3	M	9,10,11,12,13,14,15,16,17,18	3		3
4	Dublin	North	Carer	Polish	F	4	0	4	3	4	4	4	4	F	9,10,11,12,13,14,15,16,17,18	4		2
5	Dublin	North	Carer	Indian	M	5	1	5	3	5	5	5	5	M	9,10,11,12,13,14,15,16,17,18	5		1

Table 6.3 shows the client sample data**:**

Table 6.3 Client sample data table

Client data table																
ID	**Office**	**Group**	**Name**	**Gender**	**Age Group**	**Smoking**	**Hobbies**	**Language**	**Habits**	**Skillset**	**Preferred Gender**	**Experience**	**Ethnicity**	**Family Carer**	**Preferred Personality**	**Health Safety Facts**
1	Dublin	North	Client A	M	3	1	1	1	1	1	M	1	Irish	1	1	1
2	Dublin	North	Client B	F	3	0	2	2	2	2	M	2	British	2	2	2
3	Dublin	North	Client C	M	2	1	3	3	3	3	M	3	Polish	3	3	3
4	Dublin	North	Client D	F	2	0	4	4	4	4	M	4	German	4	4	4
5	Dublin	North	Client E	M	1	1	5	5	5	5	M	5	Indian	5	5	5

Evaluation sample data facts (test cases):

1. For evaluation purposes, five carers and five clients were added to the system.
2. As illustrated in the client and carer tables, preferences were tweaked in such a way that Carer-A (ID-1) preferences should be matched with Client-A (ID-1); similarly, there was a match of preferences between Carer-B and Client-B, Carer-D and Client-D, and Carer-E and Client-E, according to the scoring model design.
3. A total of 40 tasks were added, eight tasks for each client

4. All tasks were supposed to be performed on the same day.
5. Carer availability was set by default from 9-18: each comma separated value shows the hour the carer is available.
6. All carers were considered as Garda vetted.

6.3.3. Executing Program

In this section, the program is executed to evaluate the outcome. When the program starts, Figure 6.5 shows the screen that appears automatically. This is the main form of the application. When the user clicks on the red button “Schedule All Tasks”, after prompt, the program starts scheduling tasks automatically. The progress of each task scheduled shown on the top right-hand side corner marked with a red icon and numbered as 2**.** Once all 40 tasks were scheduled the system generated an alert message confirming that all tasks have been scheduled.

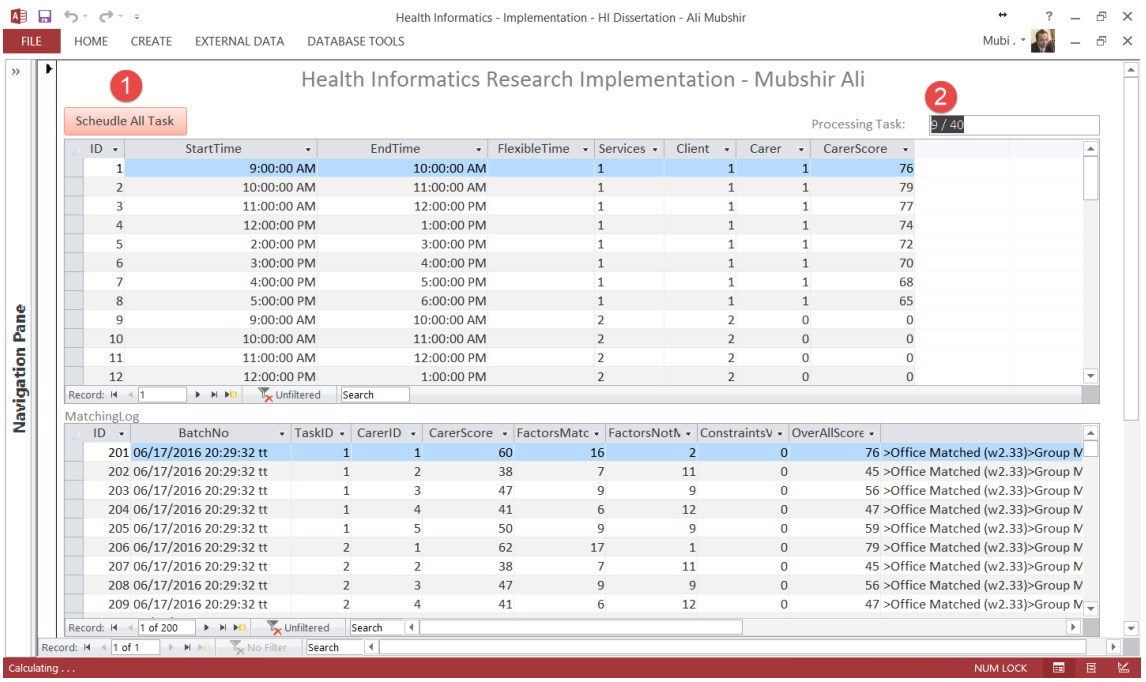

Figure 6.5. Executing the main program

6.3.4. Results Evaluation

The task data table before implementation is available in Appendix K. The carer and carer score columns are empty in that table. Once the program has allocated the tasks based on the scoring model, the carers is assigned and also the carer's score is shown, as visible in the coloured columns in the Table 6.4, which shows a snapshot of the carer table after allocation process:

Table 6.4 Snapshot of task data table after program has scheduled tasks

ID	Start Time	End Time	Services	Client	Carer	Carer Score
1	9:00:00 AM	10:00:00 AM	1	1	1	85
9	9:00:00 AM	10:00:00 AM	2	2	2	84
17	9:00:00 AM	10:00:00 AM	3	3	3	81
25	9:00:00 AM	10:00:00 AM	4	4	4	87
33	9:00:00 AM	10:00:00 AM	5	5	5	97

Table 6.5 shows the details of the reason why tasks were assigned to a carer; this is discussed in detail in the following section:

Table 6.5. Snapshot of matching log after program has scheduled tasks

ID	Task ID	Carer ID	Carer Score	Factors Matched	Factors Not Matched	Constraints Violations	Overall Score
201	1	1	66	19	1	0	85
202	1	2	42	9	11	0	51
203	1	3	51	11	9	0	62
204	1	4	45	8	12	0	53
205	1	5	51	9	11	0	60
241	9	1	-83	8	12	1	-76
242	9	2	66	18	2	0	84
243	9	3	48	10	10	0	58
244	9	4	45	8	12	0	53
245	9	5	51	9	11	0	60

281	17	1	-84	8	12	1	-77
282	17	2	-90	6	14	1	-85
283	17	3	65	16	4	0	81
284	17	4	50	10	10	0	60
285	17	5	54	10	10	0	64
321	25	1	-87	7	13	1	-81
322	25	2	-89	6	14	1	-84
323	25	3	-85	8	12	1	-78
324	25	4	70	17	3	0	87
325	25	5	51	9	11	0	60
361	33	1	-86	7	13	1	-80
362	33	2	-90	6	14	1	-85
363	33	3	-84	8	12	1	-77
364	33	4	-90	6	14	1	-85
365	33	5	78	19	1	0	97

There was a total of 40 tasks. For evaluation, the following Task-1, Task-9, and Task-17 were selected because they were assigned to different carers. It was more logical to evaluate these tasks to demonstrate the system preferences decision.

Task 1 Allocation Results Evaluation:

For Task1, the system checked client and carer preferences based on the key factors, constraints and weighting. The system shows that 20 factors matched (see matching log 6.6) between Carer-A (ID1) and Client-A (ID1); one factor did not match, and there were no constraint violations. Carer-A's total score was 85 which was higher than all other carers' scores as illustrated in the matching log data Table 6.6:

Table 6.6 Snapshot of matching log database table data for Task-1

ID	Task ID	Carer ID	Carer Score	Factors Matched	Factors Not Matched	Constraints Violations	Overall Score
201	1	1	66	19	1	0	85

202	1	2	42	9	11	0	51
203	1	3	51	11	9	0	62
204	1	4	45	8	12	0	53
205	1	5	51	9	11	0	60

One factor that did not match was 'Known Carer'. Another column has been removed due to the huge amount of data and to simplify the illustration, but this is available in the program from the above table in the 'descriptive text log' of each matching log record, whereby the details of the matching are available. The following is the text for the first record of matching log (for Task-1, Carer-1 and Client-1):

>Office Matched (w2.33)>Group Matched(w2.0)>Availability Matched (w3.44)>Work Legislation Matched (20.97)>Distance Weighting (-0)>Service Matched (2.72)>Language Matched (3.94)>Hobbies Match(1.83)>Habits Match(2.08)>Smoking Matched (2.71)>Ethnicity Matched (1.92)>Gender Matched (3.08)>Experience Carer Match(3.08)>Family Carer Match(3)>Known Carer Not Matched(-4.06)>Skillset Matched (3.83)>Personality Matched (2.28)>HealthandSafety Conflict (0)>Age Group Matched (3.14)

Because this was the first task of the client and carer together, and they were not known to each other based on the program logic, the system checks if they have any tasks scheduled already to find out if they are known. However, the matching log indicates that Task-2 was also assigned to the same carer and in this case because client and carer were both known (based on the Task-1), all 20 factors matched, as shown in the Table 6.7:

Table 6.7 Matching Log data for Task-2

ID	Task ID	Carer ID	Carer Score	Factors Matched	Factors Not Matched	Constraints Violations	Overall Score
206	2	1	68	20	0	0	88
207	2	2	42	9	11	0	51
208	2	3	51	11	9	0	62
209	2	4	45	8	12	0	53
210	2	5	51	9	11	0	60

Based on the above results it was concluded that the scoring model worked as expected and the best-matched carer was selected.

Task 9 Evaluation:

Task-9 for Client-2 was allocated to Carer-2 due to the fact they were a good match with the highest score of 84, as illustrated in the matching log data Table 6.8:

Table 6.8 Matching Log data for Task-9

ID	Task ID	Carer ID	Carer Score	Factors Matched	Factors Not Matched	Constraints Violations	Overall Score
241	9	1	-83	8	12	1	-76
242	9	2	66	18	2	0	84
243	9	3	48	10	10	0	58
244	9	4	45	8	12	0	53
245	9	5	51	9	11	0	60

In the case of carer-A, eight factors matched but 12 factors did not match: this resulted in a negative (-76) score. As per the task evaluation data table, both Task-1 and Task-9 were at the same time because Carer-1 was already allocated a task (Task-1); therefore, there was a constraint violation for Carer-1. As indicated previously the program logic does not remove carers; they are simply given -100 score, so that they still come up in the results but with a reduced score. Similarly, the remaining three carers did not achieve a high enough score to qualify for Task-9.

Task 17 Evaluation:

Task 17 for Client-3 was allocated to Carer-3 due to the fact they were best matched with the highest score of 81, as illustrated in the matching log data Table 6.9:

Table 6.9 Snapshot of matching log data for Task-17

ID	Task ID	Carer ID	Carer Score	Factors Matched	Factors Not Matched	Constraints Violations	Overall Score
281	17	1	-84	8	12	1	-77
282	17	2	-90	6	14	1	-85
283	17	3	65	16	4	0	81
284	17	4	50	10	10	0	60
285	17	5	54	10	10	0	64

The time of TasK-17 was the same as Task-1 and Task-2. Carer-A was allocated Task-1, and Carer-2 was allocated Task-3. Both had 'availability' constraint violations. Carer-3 received the maximum score.

6.4. Implementation Limitations

There were a few limitations in the design, which can be improved. These limitations are explained below:

1. Implementation was for scoring model at small scale
2. Due to limitations in MS Access, a calculated distance was added rather than calculating the distance between two points using GIS tools. However, proper weightage was calculated based on the distance.
3. Exception handling is not implemented at the full scale; therefore, tweaking data or adding new data must be carefully performed.

6.5. Implementation Improvements

Some improvements in the model can be performed to enhance the solutions:

- Introduce separate tables for multiple relationships to avoid comma separated values in some fields of the database tables.
- Add GIS features to calculate distance using GIS tools.

- Scorecard should be customisable for each client, to cater for the fact that some clients may have additional hard constraints

6.6. Conclusion

Using MS VBA and MS Access a model design was implemented to verify the actual output of the scoring model system design. The database design and code were implemented. Sample data was populated. The algorithm was implemented using VBA. The program demonstrated that the scorecard model implementation was successful, and the system was automatically allocating best-suited carers based on the factors, weightings, and constraints. Implementation limitations and improvement were also identified.

Chapter 7

Conclusion and Future Work

7.1. Introduction

This chapter outlines the strength and limitation of the study. Reflections and future recommendation are also discussed. The findings of the research will be circulated to participants and participating domiciliary care providers.

7.2. Research Summary

The researcher used a mixture of both qualitative and quantitative research methods for this study. The literature review was performed to identify key factors, weightings and constraints. To gain an Irish perspective interviews were scheduled with 15 staff members from five different domiciliary care providers, two clients who are receiving care and one HSE commissioner for HCP funding. The outcome was analysed and discussed to establish the final scorecard that should be used as basis for a scoring model. A scoring model system was designed and implemented in a computer program to evaluate the results.

7.3. Strengths and Limitations of the Research

Research has identified many key factors, weightings of these factors and constraints. This information would be very useful for domiciliary care providers who participated in this

research. They can use this scoring model to improve the quality of care by sending the right carer to a client. The system is very configurable, and weightings can be tweaked easily.

There were three major objectives of this study: finding key factors, weightings for each factor and constraints. There was little information found on weightings in the available literature, and because of this the researcher relied mainly on the interviews analysis. From the interviews, an Irish perspective on weightings was gained, but an international view of weightings could not be established.

7.4. Research Reflection

The research produced some interesting results, and the researcher realised the depth of complexity of scheduling in domiciliary care and obtained a deep insight into the scheduling process. As the researcher is working in the ICT healthcare sector, this research will help to improve the system for scheduling in domiciliary care settings.

7.5. Future Recommendation

While the research answered all the questions and completed all the objectives, there is the possibility of another study. Current implementation of scoring model (Decision Support System) with suggested improvements should be piloted in a few care provider organisations. Based on the results and findings, the model could be further matured and utilised.

7.6. Conclusion

The primary objective of this research was to identify the key factors, weightings of the key factors and the constraints for scheduling a carer in a domiciliary care setting to improve the quality of the care. Based on this, another objective was to design a scoring model and evaluate it using a computer based program. The research concluded that there are 22 key

factors, their weighting was identified, and out of these 22 factors only three were considered as hard constraints. Whilst designing the scoring model 22 factors were amalgamated into 20 factors. Furthermore, research also concluded that it was possible to design the scoring model and implement it for evaluation of the model. The evaluation results produced by the program were consistent with research outcome, and it was concluded that implementation produced the desired results as expected. Decision support, scoring model based on the key factors, weightings and constraints can help in improving the quality of scheduling and the quality of care.

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Appendix

Appendix A: Ethics Approval

From: Una O'Malley **Una.OMalley@scss.tcd.ie**
Date: 22 April 2016 at 15:55
Subject: RE: [Research-ethics] FW: Fwd: Research Ethics Application - Health Informatics 25/16
To: **alimu@tcd.ie**
Cc: **research-ethics@scss.tcd.ie** , **Mary.Sharp@scss.tcd.ie**

Dear Mubshir,
Following your earlier amendments, your ethics application has now been approved.

Regards,
Una

Una O'Malley
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Trinity College Dublin, the University of Dublin
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Appendix B: Domiciliary Care Generic Services

Domiciliary care services are generic across the board in Ireland. For example, following services are provided (IHC, 2016).

- PROVIDE PRACTICAL SUPPORT:
    - Cleaning/laundry/ironing
    - Meal preparation
    - Shopping
    - Companionship
    - Light housework
    - Collecting prescriptions
- PROVIDE PERSONAL SUPPORT:
    - Personal care
    - Bathing & Showering
    - Continence care
    - Assistance with dressing, mobility and feeding
    - Outings and socialising
    - Participate in crafts/hobbies
- PROVIDE SPECIALIST SUPPORT:
    - Assistance with daily living – e.g. catheter care, oxygen facilitation
    - Palliative care, end of life support
    - Dementia care/reminiscing therapy
    - Challenging behaviour
- Physical mobility
    - Post-discharge from hospital where assistance is required at short notice, possibly for a short period
    - Reablement Programme post hospital discharge to help people to adapt to changes in their ability post illness and to regain confidence
    - Convalescence in the home to aid recovery from a debilitating illness
    - Respite Care - giving the main carer is a break while staying at home.
    - Night care – awake or sleep over nights

Appendix C: Interview Questionnaires

C.1 Client Questionnaire

Client Questionnaire	
1	What are your expectations from a carer regarding the quality of care?
2	What are the major issues you have to deal with regarding quality service from carers?

C.2 Care Manager Questionnaire

Care Managers Questionnaire	
1	What are the key factors concerning scheduling a carer, constraints, priority, and weight?
2	Are you using any tools to help you schedule carers?
3	How can quality be improved by using key factors?
4	What are the major issues regarding scheduling carers to provide quality care?

C.3 Carer Questionnaire

Carer Questionnaire	
1	What are the key factors concerning scheduling a carer, constraints, priority, and Weight?
2	How can quality be improved by using key factors?
3	What are the major issues you have to deal with regarding scheduling to provide quality care?

C.4. HSE Commissioner Questionnaire

HSE Commissioner Questionnaire	
1	What are your expectations regarding key factors for scheduling a carer and their priority from agencies?
2	What are your major concerns regarding quality service from organisations and carers?

Appendix D: Analysis of Key Factors

D.1 Personal Factors Analysis

Theme		Factors	Interview Groups	Total Participants	Participant Who Consider Key Factor
Personal Factors	1	Gender			
			Care Manager	8	7
			Carer	6	5
			Client	2	1
	2	Age			
			Care Manager	8	7
			Carer	6	4
			Client	2	1
	3	Smoking			
			Care Manager	8	5
			Carer	6	3
			Client	2	2
	4	Hobbies			
			Care Manager	8	4
			Carer	6	2
			Client	2	1
	5	Habits			
			Care Manager	8	6
			Carer	6	2
			Client	2	1
	6	Pets			
			Care Manager	8	6
			Carer	6	5
			Client	2	0
	7	Environment			
			Care Manager	8	5
			Carer	6	5
			Client	2	0
	9	Personality			
			Care Manager	8	4
			Carer	6	4

			Client	2	1

D.2 Geographic Factors Analysis

Theme		Factors	Interview Groups	Total Participants	Participant Who Consider Key Factor
Geographic Factors	1	Location /Mobility			
			Care Manager	8	8
			Carer	6	6
			Client	2	0
	2	Office Branch			
			Care Manager	8	8
			Carer	6	0
			Client	2	0
	3	Office Group			
			Care Manager	8	8
			Carer	6	0
			Client	2	0

D.3 Professional Factors Analysis

Theme		Factors	Interview Groups	Total Participants	Participant Who Consider Key Factor
Professional Factors	1	Services Needed			
			Care Manager	8	7
			Carer	6	5
			Client	2	0
	2	Availability			
			Care Manager	8	8
			Carer	6	6

			Client	2	0
	3	Experience			
			Care Manager	8	6
			Carer	6	0
			Client	2	2
	4	Skillset /Training			
			Care Manager	8	7
			Carer	6	2
			Client	2	4
	5	Family Carer			
			Care Manager	8	6
			Carer	6	3
			Client	2	1
	6	Working Time Directive			
			Care Manager	8	8
			Carer	6	0
			Client	2	0
	7	Known Carer			
			Care Manager	8	7
			Carer	6	5
			Client	2	2
	8	Health and Safety			
			Care Manager	8	4
			Carer	6	3
			Client	2	0
	9	Garda Clearance			
			Care Manager	8	8
			Carer	6	0
			Client	2	2

D.4 Cultural Factors

Theme		Factors	Interview Groups	Total Participants	Participant Who Consider Key Factor
Cultural Factors	1	Language			
			Care Manager	8	8
			Carer	6	5
			Client	2	2
	2	Ethnicity			
			Care Manager	8	4
			Carer	6	3
			Client	2	1

Appendix E: Analysis of Weighting

E.1 Personal Factors Weighting Analysis

Theme		Factors	Interview Groups	Total Participants	Weight 1	Weight 2	Weight 3	Weight 4	Weight 5	Avg. Weight	Net. Avg. Weight
Personal Factors	1	Gender									
			Care Manager	8	1	0	3	0	4	3.75	3.08
			Carer	6	1	2	2	1	0	2.50	
			Client	2	1	0	0	0	1	3.00	
	2	Age									
			Care Manager	8	1	0	3	0	4	3.75	3.14
			Carer	6	2	0	0	0	4	3.67	
			Client	2	1	0	1	0	0	2.00	
	3	Smoking									
			Care Manager	8	3	0	1	1	3	3.13	2.71
			Carer	6	3	0	3	0	0	2.00	
			Client	2	1	0	0	0	1	3.00	
	4	Hobbies									
			Care Manager	8	4	4	0	0	0	1.50	1.83
			Carer	6	4	1	1	0	0	1.50	
			Client	2	1	0	0	1	0	2.50	
	5	Habits									
			Care Manager	8	2	2	0	4	0	2.75	2.08
			Carer	6	4	1	1	0	0	1.50	
			Client	2	1	0	1	0	0	2.00	
		Pets									
			Care Manager	8	2	3	3	0	0	2.13	2.10
			Carer	6	1	1	2	0	2	3.17	

			Client	2	2	0	0	0	0	1.00	
		Environment									2.81
			Care Manager	8	3	0	1	4	0	2.75	
			Carer	6	1	1	0	1	3	3.67	
			Client	2	1	0	1	0	0	2.00	
		Personality									2.28
			Care Manager	8	4	0	0	4	0	2.50	
			Carer	6	2	1	2	1	0	2.33	
			Client	2	1	0	1	0	0	2.00	

E.2 Geographic Factors Weighting Analysis

Theme		Factors	Interview Groups	Total Participants	Weight 1	Weight 2	Weight 3	Weight 4	Weight 5	Avg. Weight	Net. Avg. Weight
Geographic Factors	1	Location /Mobility									2.90
			Care Manager	8	0	0	1	3	4	4.38	
			Carer	6	0	3	0	1	2	3.33	
			Client	2	2	0	0	0	0	1.00	
	2	Office Branch									2.33
			Care Manager	8	0	0	0	0	8	5.00	
			Carer	6	6	0	0	0	0	1.00	
			Client	2	2	0	0	0	0	1.00	
	3	Office Group									2.00
			Care Manager	8	0	1	2	1	4	4.00	
			Carer	6	6	0	0	0	0	1.00	
			Client	2	2	0	0	0	0	1.00	

E.3 Professional Factors Weighting Analysis

Theme		Factors	Interview Groups	Total Participants	Weight 1	Weight 2	Weight 3	Weight 4	Weight 5	Avg. Weight	Net. Avg. Weight
Professional Factors	1	Services Needed									
			Care Manager	8	1	0	1	2	4	4.00	2.72
			Carer	6	1	1	2	0	2	3.17	
			Client	2	2	0	0	0	0	1.00	
	2	Availability									
			Care Manager	8	0	0	0	0	8	5.00	3.44
			Carer	6	0	0	2	0	4	4.33	
			Client	2	2	0	0	0	0	1.00	
	3	Experience									
			Care Manager	8	2	0	0	2	4	3.75	3.08
			Carer	6	6	0	0	0	0	1.00	
			Client	2	0	0	0	1	1	4.50	
	4	Skillset									
			Care Manager	8	1	0	1	2	4	4.00	3.83
			Carer	6	2	0	2	0	2	3.00	
			Client	2	0	0	0	1	1	4.50	
	5	Family Carer									
			Care Manager	8	2	0	2	0	4	3.50	3.00
			Carer	6	3	0	0	0	3	3.00	
			Client	2	1	0	0	1	0	2.50	
	6	Working Hours									
			Care Manager	8	0	0	0	0	8	5.00	2.33
			Carer	6	6	0	0	0	0	1.00	
			Client	2	2	0	0	0	0	1.00	
	7	Known Carer									4.06

			Care Manager	8	1	0	1	2	4	4.00	
			Carer	6	1	0	2	3	0	3.17	
			Client	2	0	0	0	0	2	5.00	
	8	Health and Safety									2.33
			Care Manager	8	4	0	0	0	4	3.00	
			Carer	6	3	0	0	0	3	3.00	
			Client	2	2	0	0	0	0	1.00	
		Garda Vetting									3.67
			Care Manager	8	0	0	0	0	8	5.00	
			Carer	6	6	0	0	0	0	1.00	
			Client	2	0	0	0	0	2	5.00	

E.4 Cultural Factors Weighting Analysis

Theme		Factors	Interview Groups	Total Participants	Weight 1	Weight 2	Weight 3	Weight 4	Weight 5	Avg. Weight	Net. Avg. Weight
Cultural Factors	1	Language									3.94
			Care Manager	8	0	0	0	4	4	4.50	
			Carer	6	1	3	0	0	2	2.83	
			Client	2	0	0	0	1	1	4.50	
	2	Ethnicity									1.92
			Care Manager	8	4	2	2	0	0	1.75	
			Carer	6	3	0	3	0	0	2.00	
			Client	2	1	0	1	0	0	2.00	

Appendix F: Legal Hours of Work

F.1 Working Hours

The Organization of Working Time Act 1997 states that the maximum average working week for some representatives cannot surpass 48 hours. This does not imply that a working week can never surpass 48 hours. However, the average is critical. The computation of 48 hours does exclude yearly leave, wiped out leave or maternity/supportive/parental leave. The Act also sets down principles for night specialists, breaks and rest periods. There are also rules in connection to Sunday working.

F.2 Night Working Hours

The working hours of night labourers are directed by the Organization of Working Time Act 1997. It is essential to understand what is meant by night work and a night labourer. Night work implies work done in the period between midnight and 7am. A night specialist is a worker who regularly works no less than 3 hours between midnight and 7am and who works around evening time for half of their working hours in a year.

Night labourers' hours of work:
As a rule, the maximum average working week is 48 hours. Typically, a night specialist ought not to work more than an average of 8 hours in a 24-hour period. The average is ascertained over either a 2-month period or a more drawn out period in the event that it is part of an aggregate understanding.
In the event that the night work includes uncommon dangers or physical or mental strain, then the working hours cannot surpass 8 hours in a 24-hour period. The business is required to carry out a danger evaluation with a specific end goal to figure out if the night work includes extraordinary risks or physical or mental strain.

F.3 Breaks

The general standard on breaks is that you are entitled to a break of 15 minutes following a 4 ½ hour work period. In the event that you work over 6 hours, you are entitled to a break of 30 minutes, which can incorporate the initial 15-minute break. There is no requirement to be paid for these breaks, and they are not considered a portion of the working time.
Shop representatives who work over 6 hours and whose hours of work incorporate 11.30am–2.30pm are entitled to a one-hour continuous break which must happen within those hours.
Case: If you begin work at 7am you are entitled to a 15-minute reprieve at 11.30am. At 1.15pm when you have worked 6 hours you are entitled to a break of 30 minutes. As you have officially enjoyed a break at 11.15, your manager can confine this break to 15 minutes. (On the off chance that you are working in a shop you are entitled to a one-hour break at 1.15pm.) If you begin working again at 1.30pm or 1.45pm and keep working until 6 or 6.15pm, you are entitled to an additional 15-minute break.

Representatives whose working conditions are secured by the Registered Employment Agreement (Dublin and Dun Laoghaire Drapery, Footwear and Allied Trades) are entitled to a 15-minute paid break (restrictive of the fundamental dinner break) if working more than 4 ½ hours.
Until 7 July 2011 representatives who were secured by the Employment Regulation Order (ERO) for the Retail Grocery and Allied Trades (across the nation) were qualified for a 15-minute paid break (select of the primary feast break) if working more than 4 ½ hours. Taking after a High Court Choice Employment Regulation Orders stopped to have statutory impact from 7 July 2011. Representatives who were secured by this ERO have existing contracts of vocation which oversee their states of work. Any adjustment in their agreement of vocation typically requires the representative's assent so the terms set down in the ERO still apply to workers whose agreements date from before 7 July 2011. Until new EROs are made the states of work (counting rest periods) for representatives who begin work after 7 July 2011 are administered by occupation enactment, for example, the Organization of Working Time Act 1997.

Rest periods
The meaning of a rest period is whatever time that is not working time. The rest periods set out in the Act are as follows:
(a) You are entitled to 11 back to back hours' rest in any time of 24 hours. Moreover, you ought to get 24 successive hours' rest in any 7 days' period and this ought to typically take after one of the 11-hour rest periods or
(b) As an option your manager can give both of you 24-hour rest periods in the week that tails one in which you didn't get the privilege portrayed in (an) above.
Unless previously agreed the 24-hour rest period alluded to above ought to incorporate a Sunday.

Who is not secured by the Act
The provisions of the Organization of Working Time Act 1997 on breaks and rest periods does not apply to all workers. For example, the following groups are exempt Gardaí, Defence Forces, representatives who control their own particular working hours or family representatives on homesteads or in private homes. The working hours of youngsters less than 18 years old are controlled by the Protection of Young Persons (Employment) Act 1996.

Appendix G: Design Principles

Visibility – The more obvious functions are, the more probable it is that clients will have the capacity to realise what to do next. In contrast, when functions are beyond anyone's ability to see, it makes them hard to discover and know how to utilise.

Feedback– Feedback is about sending back data about what activity has been done and what has been proficient, permitting the individual to proceed with the action. Different sorts of criticism are accessible for connection outline sound, material, verbal, and mixes of these.

Constraints – The configuration idea of compelling alludes to deciding methods for confining the sort of client association that can happen at a given minute. There are different ways this can be accomplished.

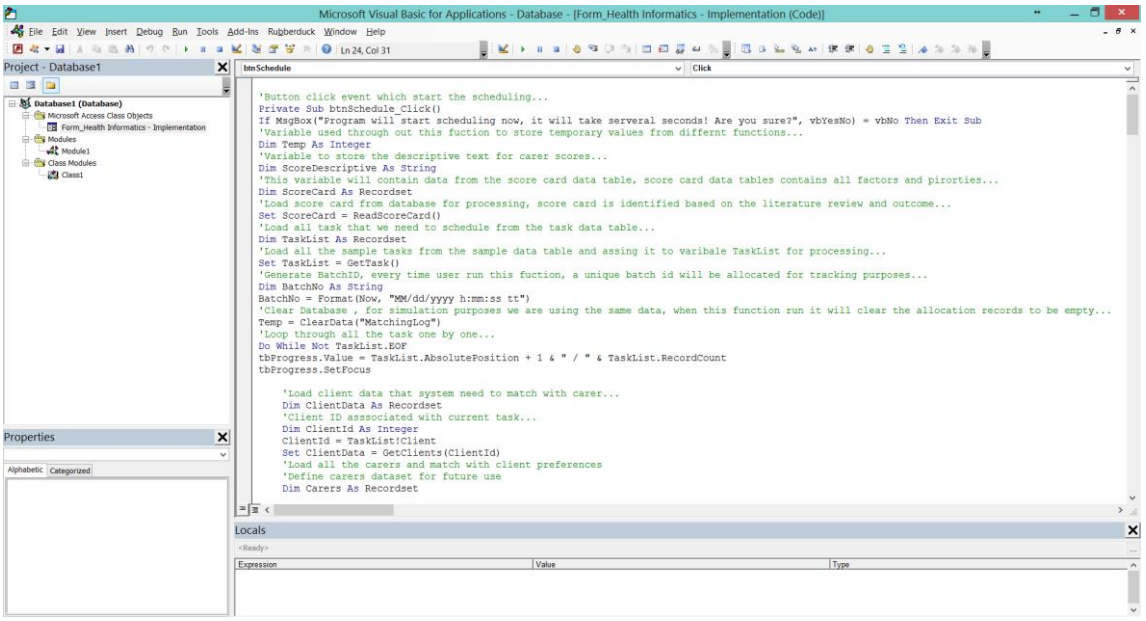
Mapping – This alludes to the relationship amongst controls and their belongings on the planet. Almost everything antiquities need some sort of mapping amongst controls and impacts, whether it is an electric lamp, auto, power plant, or cockpit. A case of a decent mapping amongst control and impact is the all over bolts used to speak to the here and there development of the cursor, separately, on a PC console.

Consistency – This alludes to outlining interfaces to have comparable operations and use comparative components for accomplishing comparable undertakings. Specifically, a steady interface is one that takes after standards, for example, utilising the same operation to choose all articles. For instance, a predictable operation is utilising the same info activity to highlight any graphical article at the interface, for example, continually tapping the left mouse catch. Conflicting interfaces, then again, permit special cases to a principle.

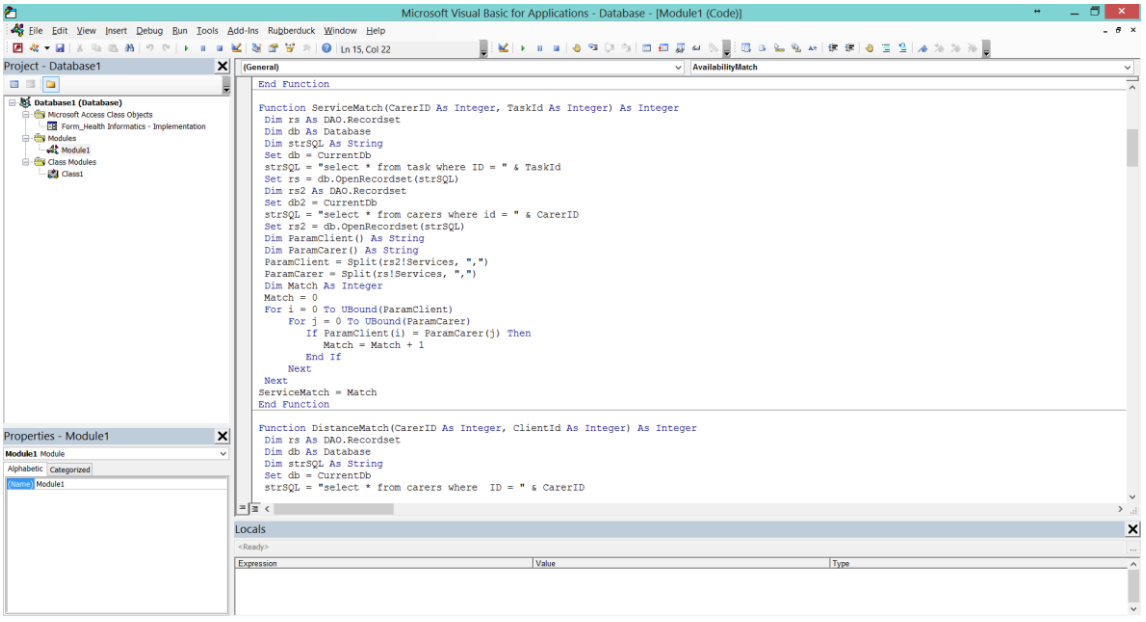
Affordance – is a term used to allude to a trait of an item that permits individuals to know how to utilise it. For instance, a mouse catch welcomes pushing (in this manner acting clicking) by the way it is physically compelled in its plastic shell. At an extremely straightforward level, to manage the cost of signifies "to provide some insight" (Norman, 1988). At the point when the affordances of a physical article are perceptually evident, it is anything but difficult to know how to associate with it (Preece, 2002).

Appendix H: Visual Basic Application Code Snippets

H.1 Main Form Code File



H.2 Module 1 Code File



Appendix I: Interview Questions and Analysis Correlation

I.1 Client Questions and Interview Outcome Correlation

Client Questionnaire		Interview outcome		
1	What are your expectations from a carers regarding a quality care?	**Participant View**	**Factor Identified**	**Avg. Client Wt.**
		1. Would prefer same gender	Gender	3.0
		2. Would like experienced carer	Experience	4.50
		3. Would prefer carer I know already	Know Carer	5.0
		4. Would prefer client with the same language	Language	4.50
		5. Would like carer who live nearby	Location	1.0
2	What are the major issues you have to deal with regarding quality service from carers?	1. Carer does not turn up on time	Availability	1.0
		2. Carer is not entirely aware of what they have to do	Experienced	4.50
		3. Don't like to explain my routine to the carer	Known Carer	5.0

I.2 Care Manager Questions and Interview Outcome Correlation

Care Managers (CM) Questionnaire		Interview Analysis		
1	What are the key factors concerning scheduling a carer, constraints, priority, and Weight?	**Participants View**	**Factor Identified**	**Avg. CM Wt.**
		1. Need to make sure carer is available for client visit	Availability **(must)**	5.0
		2. Sometimes a client has pets, and a carer has pet allergy, so cannot schedule carer due to this	Pets	2.13
		3. Sometimes a client requires a carer in the same age group client (not often)	Age	3.75
		4. Sometimes client requires carer with the same gender (not often)	Gender	3.75
		5. It is not very often but sometimes clients do enquire if a carer smokes or not	Smoking	3.13
		6. Normally this does not change our decision, but we do try to match up client and carer with the same hobbies and habits.	Hobbies Habits	1.50 2.75
		7. The physical environment of the client house plays an important role when scheduling a carer.	Environment	2.75
		8. Based on the client's personality we schedule suitable carer	Personality	2.50
		9. Always try to send the nearest carer based on his house location or his previous visit location, whichever is most appropriate. This will also depend on the carer's mode of transport for example public transport or car.	Location /Mobility	2.90
		10. Based on the client's needs we send appropriate carer with appropriate skillset	Service needed	4.0
		11. If client is high priority (need special care), we try to send the experience carer	Experience	3.75
		12. Clients normally prefer carers they already know or a family carer if available.	Known carer Family carer	4.0 3.50

		13. Sometimes carer is reluctant to go to clients who have tendency to provoke discrimination and racism or get violent and abusive	Health/safety Ethnicity	2.33
		14. Carer can only be scheduled for 48 hours a week	Working Hours **(must)**	5.0
		15. Carer has to be Garda vetted before we can schedule the client visit	Garda Vetting **(must)**	5.0
		16. Clients prefer carer who can speak and understand English	English	4.50
2	Are you using any tools to help you schedule the carers?	Answer to this question most of the care manager were using some technical solution for client and carer management and rostering.		
3	How can quality be improved by using key factors?	The answer to this question most of the carer agreed that by having a solution that would help them to easily identify best-suited carer for a client would help in improving the quality of care.		
4	What are the major issues regarding scheduling carers to provide quality care?	**Participants View**	**Factor Identified**	**Avg. CM WTG.**
		1. It is very hard to get carers for night visits	Availability **(must)**	5.0
		2. Sometimes carers refuse to go to clients who live in an area which is considered dangerous due to crime rate etc.	Environment	2.75
		3. Sometimes a client behaviour make it is very hard to match up the best carer.	Personality	2.50
		4. Sometimes client only wants an Irish carer (mostly elderly clients)	Health/safety Ethnicity	2.33

I.3 Carer Questions and Interview Outcome Correlation

Carer Questionnaire		Interview Analysis		
1	What are the key factors concerning scheduling a carer, constraints, priority, and Weight?	**Participants View**	**Factor Identified**	**Avg. CM WTG.**
		1. Prefer a client's house where there is no cigarette smoke smell.	Smoking Environment	2.0

		2. Get on well with nice clients with similar personal traits	Hobbies Habits Personality Known Carer	1.50 1.50 2.33 3.17
		3. Need to know if client has infectious disease	Health/safety Ethnicity	3.0 1.92
		4. Do not like to visit client's with dogs due to allergy	Pets	3.17
		5. Like to visit client within the same age group	Age	3.67
		6. Like to get more training to meet the client's needs and work more professionally	Skillset Serviced need	3.0 3.17
2	How can quality be improved by using key factors?	Answers to this question: most of the carer stated that by matching up key factors and scheduling carer and a client who get along can make the working environment more productive and improve the quality of care.		
3	What are the major issues you have to deal with regarding scheduling to provide quality care?	**Participants View**	**Factor Identified**	**Avg. CM Wt.**
		1. Sometimes client is abusive	Ethnicity Personality Environment	2.0 2.33 3.67
		2. We are not told if the client has some infectious disease such as HIV, it would be better if we know so that we can take precautions.	Health and Safety	3.0

I.4 HSE Commissioner Questions and Interview Outcome Correlation

HSE Manager Questionnaire		**Interview Analysis**		
1	What are your expectations regarding key factors for scheduling a carer and their priority from agencies?	**Participants View**	**Factor Identified**	**Avg. CM Wt.**
		1. Carers are Garda vetted	Garda Vetting	NA
		2. Carers are punctual and working the hours they are supposed to work	Availability **(must)** Working Hours	NA
		3. Carers are properly trained	Skillset Services needed	NA

		4. Carers are building a relationship with client	Personality Habits Hobbies	NA
		5. Agencies are meeting SLAs	NA	
2	What are your major concerns regarding quality service from agencies and carers?	Carers are not turning up when they are supposed to and doing hours they are required to.		

Appendix J: Implementation Database Tables

J.1 Carer Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each carer
Office	Short Text	Office name to which carer belongs
Group	Short Text	Group name to which carer belongs
Name	Short Text	Name of carer
DOB	Date/Time	Date of birth of carer
Address	Date/Time	Adress of carer
Location	Short Text	Location of carer
Ethnicity	Short Text	Ethnicity of carer
Gender	Short Text	Gender of carer
Experience	Number	Working experience of carer in years
Smoking	Number	Is carer smoking or non-smoking
Services	Short Text	Service carer can provide
Mobility	Number	Mobility of carer, how far carer can travel, for example car, bus or bike
Skillset	Short Text	Special skills carer has
Hobbies	Short Text	Hobbies of carer
Language	Short Text	Languages carer can speak
Habits	Short Text	Habits of carer
PreferedGender	Short Text	Prefered gender of carer
Availability	Short Text	Availability of carer
Personality	Short Text	Personality of carer
GardaVetted	Date/Time	Garda vetting date
HealthSafetyConcerns	Short Text	Health & Safety Concerns

J.2. Client Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each client
Office	Short Text	Office to which client is registered
Group	Short Text	Group to which client is registered
Name	Short Text	Name of client
DOB	Date/Time	Client date of birth
Location	Short Text	Location of client home
Gender	Short Text	Gender of client
AgeGroup	Number	Age group client would like to recieve service from
Smoking	Number	Smoking or non-smoking client
Hobbies	Short Text	Hobbies of client
Language	Short Text	Client language preferences
Habits	Short Text	Habits of clients
Skillset	Short Text	Skillset of clients
PreferredGender	Short Text	Prefered gender of client
Experience	Number	Experience of client
Ethnicity	Short Text	Ethnicity of client
FamilyCarer	Short Text	Client family carers
Personality	Short Text	Personality of client
HealthSafetyFacts	Short Text	Health & safety related facts for client

J.3. Services Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each service
Service	Short Text	Service description
Weightage	Number	Service weightage

J.4. Skillset Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each skillset
Skillset	Short Text	Description of skillset
Weightage	Number	Weightage of skillset

J.5. Language Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each language
Language	Short Text	Language name
Weightage	Number	Weightage of language

J.6. Hobbies Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each hobby
Hobby	Short Text	Description of hobby
Weightage	Number	Weightage of each hobby

J.7. Age-group Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each age group
AgeGroup	Short Text	ɔel of age group
Weightage	Number	Weightage of age group

J.8. Habit Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for habit
Habit	Short Text	Habit description
Weightage	Number	Weightage habit

J.9. Mobility Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each carer mobility
Service	Short Text	Transport avilable to carer
Distance	Number	Distance carer can cover
Weightage	Number	Weightage of each distance

J.10. Personality Data Table Design

Field Name	Data Type	Description (Optional)
ID	AutoNumber	PK-Unique Identifier (UID) for each personality item
Personality	Short Text	Personality type
Weight	Number	Weight of personality type

J.11. Health and Safety Data Table Design

Field Name	Data Type	Description (Optional)
ID	AutoNumber	PK-Unique Identifier (UID) for each Health & Safety Item
HealthSafety	Short Text	Health & Safety items
Weight	Number	Weight of health and safety item

J.12. Task Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each task
StartTime	Date/Time	Start date and time of task
EndTime	Date/Time	End date and time of task
FlexibleTime	Short Text	Is task time flexible
Services	Short Text	Services needed for this task
Client	Number	Client linked with this task
Carer	Number	Carer linked with this task
CarerScore	Number	Carer score for this task

J.13. Scorecard Data Table Design

Field Name	Data Type	Description (Optional)
ID	Number	PK-Unique Identifier (UID) for each score card factor
SourceEntity	Short Text	ent related factors
SourceObject	Short Text	Name of factor
SourceValue	Short Text	Value of factor
CompareObject	Short Text	Carer related factors name
CompareValue	Short Text	Carer factor value
Constraint	Short Text	Is this a constraint
Action	Short Text	What action is required
Pirority	Number	Pirority of the score

Appendix K: Implementation Sample Data

K.1. Location/Mobility Sample Data

Each record has different weighting this is because a carer with a car should get more weighting than with a bike. During logic implementation, this weighting is multiplied by the weighting identified based on the discussion in **Chapter 5**.

Location/Mobility			
ID	**Service**	**Distance**	**Weighting**
1	Locality	3	1
2	Bike	5	2
3	Car	10	3

K.2. Habits Sample Data

Habits		
ID	**Habit**	**Weighting**
1	Exercise	1
2	Talking	1
3	Wake up Early	1
4	Eat Healthy Food	1
5	Cleanliness	1

K.3. Age Group Sample Data

Age Group		
ID	**Age Group**	**Weighting**
1	18 to 34	1
2	35 to 49	1
3	50 to 64	1
4	65 to 74	1

K.4. Hobbies Sample Data

Hobbies		
ID	**Hobby**	**Weighting**
1	Antiques	1
2	Swimming	1

Hobbies		
ID	**Hobby**	**Weighting**
3	Cooking	1
4	Astrology	1
5	Astronomy	1
6	Fishing	1
7	Camping	1
8	Ballroom Dancing	1
9	Birdwatching	1
10	Painting	1
11	Reading	1
12	Writing	1
13	Surfing	1
14	Camping	1
15	Gardening	1
16	Coin Collecting	1

K.5. Language Table Data

Language		
ID	**Language**	**Weighting**
1	Irish	1
2	English	1
3	Polish	1
4	Indian	1
5	German	1
6	Portuguese	1

K.6. Personality Sample Data

Personality		
ID	**Personality**	**Weight**
1	Active	1
2	Aspiring	1
3	Balanced	1
4	Caring	1
5	Charming	1
6	Cheerful	1
7	Clean	1

K.7. Health and Safety Data

Health and Safety		
ID	**Health & Safety**	**Weight**
1	Cat pets	1
2	Dog pets	1
3	Snake pets	1
4	Faulty or unmaintained equipment	1
5	Mould growth on continually wet surfaces	1

K.8. Skillset Sample Data

Skillset		
ID	**Skillset**	**Weighting**
1	Strong Interpersonal Skills	1
2	Independence and Initiative	1
3	Patience and Flexibility	1
4	Clinical Skills	1

K.9. Service Table Data

Services		
ID	**Service**	**Weighting**
1	DOMICILIARY SERVICES	1
2	SPECIALIST SERVICES	1
3	REABLEMENT	1
4	INDEPENDENT LIVING	1
5	TRAINING	1

K.10. Distance Sample Data

Distance			
ID	**Client ID**	**Carer ID**	**Distance**
1	1	1	1
2	2	1	2
3	3	1	3
4	4	1	4

Distance			
ID	**Client ID**	**Carer ID**	**Distance**
5	5	1	5
6	1	2	1
7	2	2	2
8	3	2	3
9	4	2	4
10	5	2	5
11	1	3	1
12	2	3	2
13	3	3	3
14	4	3	4
15	5	3	5
16	1	4	1
17	2	4	2
18	3	4	3
19	4	4	4
20	5	4	5
21	1	5	1
22	2	5	2
23	3	5	3
24	4	5	4
25	5	5	5

K.11 Carer Sample Data

Carer Data Table																		
ID	**Office**	**Group**	**Name**	**Ethnicity**	**Gender**	**Experience**	**Smoking**	**Services**	**Mobility**	**Skillset**	**Hobbies**	**Language**	**Habits**	**Preferred Gender**	**Availability**	**Preferred Personality**	**Garda Vetted**	**Health Safety Concerns**
1	Dublin	North	Carer	Irish	M	1	1	1	3	1	1	1	1	M	9,10,11,12,13, 14,15,16,17,18	1		5

Carer Data Table																		
ID	**Office**	**Group**	**Name**	**Ethnicity**	**Gender**	**Experience**	**Smoking**	**Services**	**Mobility**	**Skillset**	**Hobbies**	**Language**	**Habits**	**Preferred Gender**	**Availability**	**Preferred Personality**	**Garda Vetted**	**Health Safety Concerns**
2	Dublin	North	Carer	British	F	2	0	2	3	2	2	2	2	F	9,10,11,12,13, 14,15,16,17,18	2		4
3	Dublin	North	Carer	Germa	M	3	1	3	3	3	3	3	3	M	9,10,11,12,13, 14,15,16,17,18	3		3
4	Dublin	North	Carer	Polish	F	4	0	4	3	4	4	4	4	F	9,10,11,12,13, 14,15,16,17,18	4		2
5	Dublin	North	Carer	Indian	M	5	1	5	3	5	5	5	5	M	9,10,11,12,13, 14,15,16,17,18	5		1

K.12. Client Sample Data

Client															
ID	**Office**	**Group**	**Name**	**Gender**	**Age Group**	**Smoking**	**Hobbies**	**Language**	**Habits**	**Skillset**	**Preferred Gender**	**Experience**	**Ethnicity**	**Family Carer**	**Preferred**	**Health Safety Facts**
1	Dublin	North	Client A	M	3	1	1	1	1	1	M	1	Irish	1	1	1
2	Dublin	North	Client B	F	3	0	2	2	2	2	M	2	British	2	2	2
3	Dublin	North	Client C	M	2	1	3	3	3	3	M	3	Polish	3	3	3

Client															
ID	Office	Group	Name	Gender	Age Group	Smoking	Hobbies	Language	Habits	Skillset	Preferred Gender	Experience	Ethnicity	Family Carer	Preferred	Health Safety Facts
4	Dublin	North	Client D	F	2	0	4	4	4	4	M	4	German	4	4	4
5	Dublin	North	Client E	M	1	1	5	5	5	5	M	5	Indian	5	5	5

K.13. Task Sample Data before Program Execution

Task							
ID	Start Time	End Time	Flexible Time	Services	Client	Carer	Carer Score
1	9:00:00 AM	10:00:00 AM		1	1	0	0
2	10:00:00 AM	11:00:00 AM		1	1	0	0
3	11:00:00 AM	12:00:00 PM		1	1	0	0
4	12:00:00 PM	1:00:00 PM		1	1	0	0
5	2:00:00 PM	3:00:00 PM		1	1	0	0
6	3:00:00 PM	4:00:00 PM		1	1	0	0
7	4:00:00 PM	5:00:00 PM		1	1	0	0
8	5:00:00 PM	6:00:00 PM		1	1	0	0
9	9:00:00 AM	10:00:00 AM		2	2	0	0
10	10:00:00 AM	11:00:00 AM		2	2	0	0
11	11:00:00 AM	12:00:00 PM		2	2	0	0
12	12:00:00 PM	1:00:00 PM		2	2	0	0
13	2:00:00 PM	3:00:00 PM		2	2	0	0
14	3:00:00 PM	4:00:00 PM		2	2	0	0
15	4:00:00 PM	5:00:00 PM		2	2	0	0
16	5:00:00 PM	6:00:00 PM		2	2	0	0
17	9:00:00 AM	10:00:00 AM		3	3	0	0
18	10:00:00 AM	11:00:00 AM		3	3	0	0

Task							
ID	**Start Time**	**End Time**	**Flexible Time**	**Services**	**Client**	**Carer**	**Carer Score**
19	11:00:00 AM	12:00:00 PM		3	3	0	0
20	12:00:00 PM	1:00:00 PM		3	3	0	0
21	2:00:00 PM	3:00:00 PM		3	3	0	0
22	3:00:00 PM	4:00:00 PM		3	3	0	0
23	4:00:00 PM	5:00:00 PM		3	3	0	0
24	5:00:00 PM	6:00:00 PM		3	3	0	0
25	9:00:00 AM	10:00:00 AM		4	4	0	0
26	10:00:00 AM	11:00:00 AM		4	4	0	0
27	11:00:00 AM	12:00:00 PM		4	4	0	0
28	12:00:00 PM	1:00:00 PM		4	4	0	0
29	2:00:00 PM	3:00:00 PM		4	4	0	0
30	3:00:00 PM	4:00:00 PM		4	4	0	0
31	4:00:00 PM	5:00:00 PM		4	4	0	0
32	5:00:00 PM	6:00:00 PM		4	4	0	0
33	9:00:00 AM	10:00:00 AM		5	5	0	0
34	10:00:00 AM	11:00:00 AM		5	5	0	0
35	11:00:00 AM	12:00:00 PM		5	5	0	0
36	12:00:00 PM	1:00:00 PM		5	5	0	0
37	2:00:00 PM	3:00:00 PM		5	5	0	0
38	3:00:00 PM	4:00:00 PM		5	5	0	0
39	4:00:00 PM	5:00:00 PM		5	5	0	0
40	5:00:00 PM	6:00:00 PM		5	5	0	0

K.14. Scorecard Sample Data

Scorecard					
ID	**Source Entity**	**Source Object**	**Carer Compare Object**	**Constraint**	**Action**
1	Client	Office	Office	Soft	2.33
2	Client	Group	Group	Soft	2.0
3	Task	Start. Time /End. Time	Availability	Hard	3.44
4	Task	Duration	Worked. Hours	Hard	2.33
5	Client	Location	Location	Soft	2.90
6	Client	Service	Service	Soft	2.72
7	Client	Language	Language	Soft	3.94

Scorecard					
ID	**Source Entity**	**Source Object**	**Carer Compare Object**	**Constraint**	**Action**
8	Client	Hobbies	Hobbies	Soft	1.83
9	Client	Habits	Habits	Soft	2.08
10	Client	Smoking	Smoking	Soft	2.71
11	Client	Gender	Gender	Soft	3.08
12	Client	Experience	Experience	Soft	3.08
13	Client	Family. Carer	Family. Carer	Soft	3.0
14	Client	Know. Carer	Known. Carer	Soft	4.06
15	Client	Skillset	Skillset	Soft	3.83
16	Client	Preferred Age Group	Age	Soft	3.14
17	NA	NA	Garda Vetted	Hard	3.66
18	Client	Personality	Personality	Soft	2.28
19	Client	Health and Safety	Health and Safety Concern	Soft	2.33
20	Client	Ethnicity	Ethnicity	Soft	1.92

Appendix L: Interviews Sample Data Notes (Anonymised)

L.1 Information Sheet for Care Manager

TRINITY COLLEGE DUBLIN
INFORMATION SHEET FOR PROSPECTIVE PARTICIPANTS
(Homecare Manager)

LEAD RESEARCHER: Mubshir Raza Ali
BACKGROUND OF RESEARCH:
This research is about finding key parameters for caregiver to provide quality care in domiciliary home care settings. As elderly population grows, there is increasing load on the home care providers. While providing service is one thing and providing quality service is another thing.
PROCEDURES OF THIS STUDY:
Qualitative research methods will be used to collect the data in face to face meetings. These include voluntary agencies (working with HSE) and private agencies. Based on the data collected key parameters and weightage will be determined and compared with the literature review. . The captured interview data will be systematically analysed to illicit requirements and themes will be obtained. Following is the research question:

- What are the key parameters for an effective care giver allocation scoring model to provide quality home care in domiciliary care settings?

Following are various objectives that we want to achieve through this research:

- Identify if there are any key parameters for caregiver allocation
- What are the expectations of HSE from caregivers
- What are the expectations of Home care managers for caregiver allocation
- What are the expectations of Patient from caregivers

Based on preliminary study following stakeholders has been identified…

- Caregivers
- Homecare Manager
- Patient/Client/Service Users
- HSE Manager

The other important information includes:

1. The researcher Mr. Ali works for an IT company who develops healthcare software. He has been part of the implementation team as project manager for Homecare products in Ireland.
2. You will be interviewed in this study in order to find the key parameters for scheduling caregiver to provide quality care. You are randomly selected because you have been part of proving home care service in domiciliary home care settings in Ireland. You will be part of one of Homecare Manager.
3. Each question is optional. Feel free to omit a response to any question: however I would be grateful if all questions are responded to.
4. The interview will be recorded on an audio device and stored securely encrypted. They will be disposed of once the transcripts are made/confirmed. The interview will not involve any video recording or photographing
5. No audio recordings will be made available to anyone other than the researcher, nor will any such recordings be replayed in any public forum or presentation of the research
6. You may stop electronic recordings at any time, even subsequent to your participation have such recordings destroyed (except in situations such as above)
7. Your participation is fully anonymous and no personal details or medical history about you will be asked. The interview data will be used for scientific purposes in a way that does not reveal your identity
8. In an extremely unlikely event if an illicit activity is reported to me inadvertently during the study I will be obliged to report it to appropriate authorities
9. The interview data extracted from the audio will be sent back to you for review within one week after the interview. The data will only be included in the study upon receiving confirmation from you about the correct interpretation of your answers recorded during the interview
10. The interview does not involve viewing/video recording of computer monitor or any other printed personal material.
11. This study is being carried out as part of fulfilment of the MSc. Health Informatics course at Trinity College, Dublin. The results may be published at conferences or in journals or other scientific publications. Also put this in the Information Sheet.

RESEARCHERSCONTACTDETAILS: Mubshir Raza Ali email- alimu@tcd.ie cell- +353(87) 6876682

SCSS Research Ethics Application Form August 2014

L.2 Signed Consent Form (Anonymised)

TRINITY COLLEGE DUBLIN
INFORMED CONSENT FORM (Homecare Manager)

LEAD RESEARCHERS: Mubshir Raza Ali

BACKGROUND OF RESEARCH:

This research is about finding key parameters for caregiver to provide quality care in domiciliary home care settings. As elderly population grows, there is increasing load on the home care providers. While providing service is one thing and providing quality service is another thing.

PROCEDURES OF THIS STUDY:

Qualitative research methods will be used to collect the data in face to face meetings. These include voluntary agencies (working with HSE) and private agencies. Based on the data collected key parameters and weightage will be determined and compared with the literature review. . The captured interview data will be systematically analysed to illicit requirements and themes will be obtained. Following is the research question:

- What are the key parameters for an effective care giver allocation scoring model to provide quality home care in domiciliary care settings?

Following are various objectives that we want to achieve through this research:

- Identify if there are any key parameters for caregiver allocation
- What are the expectations of HSE from caregivers
- What are the expectations of Home care managers for caregiver allocation
- What are the expectations of Patient from caregivers

Based on preliminary study following stakeholders has been identified…

- Caregivers
- Homecare Manager
- Patient/Client/Service Users
- HSE Manager

PUBLICATION:

This study is being carried out as part of fulfilment of the MSc. Health Informatics course at Trinity College, Dublin. The results may be published at conferences or in journals or other scientific publications. Also put this in the Information Sheet.

DECLARATION:

- I am 18 years or older and am competent to provide consent.
- I have read, or had read to me, a document providing information about this research and this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction and understand the description of the research that is being provided to me.
- I agree that my data is used for scientific purposes and I have no objection that my data is published in scientific publications in a way that does not reveal my identity.
- I understand that if I make illicit activities known, these will be reported to appropriate authorities.
- I understand that I may stop electronic recordings at any time, and that I may at any time, even subsequent to my participation have such recordings destroyed (except in situations such as above).
- I understand that, subject to the constraints above, no recordings will be replayed in any public forum or made available to any audience other than the current researchers/research team.
- I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights.
- I understand that I may refuse to answer any question and that I may withdraw at any time without penalty.
- I understand that my participation is fully anonymous and that no personal details about me will be recorded.
- I have received a copy of this agreement.

PARTICIPANT'S NAME:

PARTICIPANT'S SIGNATURE:

Date:

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

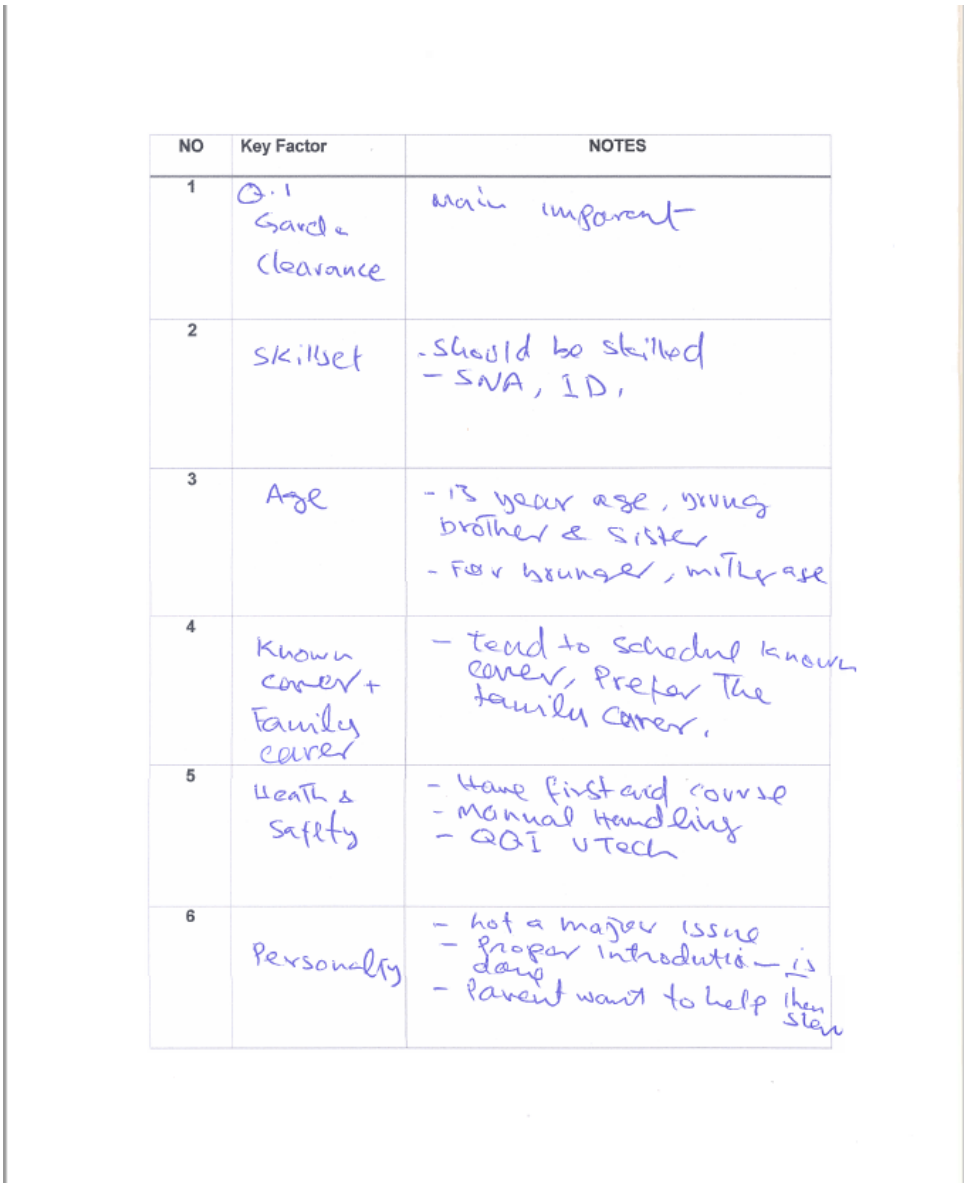
RESEARCHERS CONTACT DETAILS: Mubshir Raza Ali email- alimu@tcd.ie cell- +353(87) 6876682

INVESTIGATOR'S SIGNATURE: (Me.)

Date:

SCSS Research Ethics Application Form August 2014

L.3 Interview Sample Key Factors Notes



NO	Key Factor	NOTES
1	Q.1 Garda Clearance	Main important
2	Skillset	- Should be skilled - SNA, ID,
3	Age	- 13 year age, giving brother & sister - For younger, mitigate
4	Known carer + Family carer	- tend to schedul known carer, Prefer The family carer.
5	Heath & Safety	- Have first aid course - Manual Handling - QQI UTech
6	Personality	- not a major issue - Proper Introduction is done - Parent want to help then stop

NO	Key Factor	NOTES
1	Q3.	-Quality can be improved Specially communication factors Also these factors can Improve quality
2		- Keep Cares update about The feedback from client.
3	Q4.	- office area group is an issue - Skills hard to get
4		
5		
6		

L.4 Interviews Sample Weighting and Constraints Notes

No.	Theme	Factor	Consider Key Factor	Weightage 1-5	Constraint
1	Personal	Gender	✓	3½	
2		Age	✓	3	
3		Smoking	✓	2½	
4		Hobbies	✓	3	
5		Habits			
6		Pet	✓	1	
7		Environment			
8		Personality	✓	4	
9	Professional	Service Needed	✓	4	
10		Availability	✓	4	✓
11		Experience	✓	4	
12		Skillset	✓	3	
13		Family Carer	✓	3	
14		Working Time Directive	✓	2	✓
15		Garda Vetting	✓	5	✓
16		Know Carer	✓	5	✓
17		Health and Safety	✓	5	
18	Regional	Location/Mobility	✓	2½	
19		Office Branch			
20		Office Group			
21	Cultural	Language	✓	5	
22		Ethnicity			

Appendix M: Interview and Research Objective Correlation

M.1 Client Questionnaire and Research Objective Correlation

Client Questionnaire		Research Objectives
1	What are your expectations from a carer regarding the quality of care?	1. Identity the Key factors
2	What are the major issues you have to deal with regarding quality service from carers?	2. Identify the weighting 3. Identify and constraints

M.2 Care Manager Questionnaire and Research Objective Correlation

Care Managers Questionnaire		Research Objectives
1	What are the key factors concerning scheduling a carer, constraints, priority, and Weight?	1. Identify the Key factors 2. Identify the weighting 3. Identify and constraints
2	Are you using any tools to help you schedule carers?	4. Design the scoring model
3	How can quality be improved by using key factors?	5. Identity the Key factors
4	What are the major issues regarding scheduling carers to provide quality care?	6. Identity the constraints

M.3 Carer Questionnaire and Research Objective Correlation

Carer Questionnaire		Research Objectives
1	What are the key factors concerning scheduling a carer, constraints, priority, and Weight?	1. Identify the Key factors 2. Identify the weighting 3. Identify and constraints
2	How can quality be improved by using key factors?	4. Identity the Key factors
3	What are the major issues you have to deal with regarding scheduling to provide quality care?	5. Identity the constraints

M.4. HSE Commissioner Questionnaire and Research Objective Correlation

HSE Commissioner Questionnaire		**Research Objectives**	
1	What are your expectations regarding key factors for scheduling a carer and their priority from agencies?	1.	Identify the key factors
2	What are your major concerns regarding quality service from agencies and carers?	2.	Identify the constraints