Dementia in Older adults with intellectual disabilities

A report on the State of Science on Dementia in older adults with Intellectual Disabilities by the IASSID Special Interest Research Group on Ageing and Intellectual Disabilities.

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Life expectancy of individuals with intellectual disabilities (ID) has significantly increased over the past fifty years and this has led to an increased risk of ageing associated disability in mental and neurological functions. As with the general population, dementia is a growing source of morbidity and mortality, and is known to be associated with unique caregiver issues, considerable burden and rising care costs.

In the lead up to the 13th World Congress of IASSID, the Special Interest Research Group on Ageing and Intellectual Disabilities reviewed the state of literature on ageing issues in people with ID published between 1997 and 2008.

This report concerns Dementia - epidemiology, presentation, diagnosis, management and care-giving.

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Introduction

The usually progressive syndrome of dementia is defined in DSM-IV as a “loss of memory plus impairment in at least one other cognitive function, such as aphasia, apraxia, agnosia; and disturbance in executive function, which is severe enough to interfere with activities of daily living and represents a decline” (American Psychiatric Association, 1994). The diagnosis of ‘dementia’ is made when symptoms have been present for a period (at a minimum 6 months according to the ICD-10), having ruled out treatable conditions or illnesses.

Like ‘Intellectual Disabilities ’ the syndrome of ‘Dementia’ has numerous causes, multiple proposed pathological mechanisms and a variety of clinical manifestations, any and all of which may occur amongst people with baseline normal ability, those with acquired brain damage and those with lifelong cognitive impairment. The dementias are often categorized into two groups – non-degenerative or “treatable” dementias, such as those due to alcohol abuse, vitamin deficiencies, and infections including HIV or Creuzfeldt-Jacob Disease; or degenerative dementias such as Alzheimer’s disease. In general, the pathological processes and causes of dementia are poorly understood, but in neurodegenerative types it appears to be associated with abnormal protein deposition (e.g. of amyloid β, tau protein or α synuclein) in and around brain blood vessels and nerve cells, as well as brain cell degeneration (Lahiri et al. , 2004).

The ageing-related cognitive neurodegenerative dementias manifest clinically as Alzheimer’s Disease (most common, about 60% of all dementias), Fronto-temporal Dementia (about 5 - 10%) and Lewy Body Dementia (about 10%). The clinical picture known as Vascular Dementia (on its own or mixed with AD) includes a history of cerebrovascular events, and occurs in about 20% of cases. Although we can describe some correlations between the clinical manifestations and the microscopic findings at post mortem, these correlations are not perfect. Alternative approaches include classification of subtypes according to the site of damage (eg fronto-temporal) or to levels of behavioural and psychological symptom support needs (Brodaty, Draper and Low, 2003).

A previous review has suggested that the epidemiological pattern i.e. the incidence and prevalence of dementia (particularly Alzheimer’s Disease) among the ID population may differ from that in the general population, at least in specific subgroups such as Down Syndrome (DS) (Zigman, Schupf, Haveman, & Silverman, 1997). There are also several reasons why dementia may present atypically in the ID population. The perception of decline and the way it manifests will depend on the premorbid level of ID and pattern of cognitive abilities, and the environmental demands placed on the person. Co-morbid conditions such as epilepsy will further complicate the picture, and ageing itself may contribute to some degree of decline. The application of standard diagnostic criteria, which are based on the development of specific cognitive deficits in adults without ID, therefore requires careful consideration (Aylward, Burt, Thorpe, & Lai, 1997; Janicki,

Heller, Seltzer, & Hogg, 1996; Thorpe, Davidson, & Janicki, 2001).

The study of 'dementia' in relation to people with ID is fraught with other anomalies. We now know that almost all adults with Down Syndrome have the microscopic plaques and tangles associated with a diagnosis of Alzheimer's Disease (AD) in their thirties, but many never develop the signs or symptoms of dementia, and that older males with fragile X pre-mutation may develop Fragile X associated Tremor Ataxia Syndrome , characterized by mobility problems and sometimes mild cognitive decline.

Aims

We aimed to update and summarize current knowledge on dementia in older adults with ID through a systematic review of the published literature over the past decade, i.e. from 1997 – 2008, addressing:

1. epidemiology, with a specific focus on genetic syndromes and their association with dementia;
2. presentation and symptoms;
3. the assessment and diagnosis of dementia in this population;
4. the management – both pharmacological and behavioural; and
5. the impact on carers.

Method

Systematic literature search

We undertook computerized searches of Medline, EMBASE, and Psychinfo using the exploded MESH term "mental retardation", as well as title and abstract searches for equivalent terms (mental retardation or mental handicap or intellectual disabilit* or learning disabilit*). We also used the MESH term "Down syndrome", as well as title and abstract searches for equivalent terms (Down's syndrome or Down syndrome). These were combined (using the AND function) with the exploded MESH term "dementia" as well as title and abstract searches for dementia and equivalent terms (Alzheimer's disease or vascular dementia or Parkinson's dementia or Lewy body dementia or fronto-temporal dementia or front* degeneration). The search was limited to publication dates from 1997, and was undertaken at the end of April 2008. This strategy delivered several thousand abstracts.

Enhanced search for ID syndromes and dementia

Since the general search term "mental retardation" and its equivalents may not include all ID syndromes, and because we had a particular interest in dementia in specific syndromes,

additional searches were performed for known ID syndromes, which were combined with the term "dementia" in the title or abstract. Finally, we searched for data on mortality in specific syndromes (without date limiters), in order to find out whether individuals with a specific syndrome may reach adulthood and therefore be at risk of developing dementia.

Selection of papers

We selected papers in English, Dutch or German reporting original research on epidemiology, diagnosis and other clinical aspects; and care and treatment of dementia in ID. We also included reviews published since 2003. We excluded case reports (unless it described specific syndromes) as well as basic sciences research unless it concerned humans with dementia and reported clinical associations. The reviewers added relevant publications from their personal collections if not already included.

Epidemiology of dementia in adults with ID

Studies concerned with the prevalence or incidence of dementia in older adults with ID are summarized in tables 1 and 2. We have not included studies that have focused on longitudinal change without making a diagnosis of dementia, (e.g. Carr, 2003; Oliver, Crayton, Holland, Hall, & Bradbury, 1998; Zigman, Schupf, Urv, Zigman, & Silverman, 2002) which are summarized elsewhere (Carr, 2005). Since prior research indicates that the risk of dementia, and in particular AD, is much higher among the population with DS, we classified the papers into one of the following three categories:

1) studies which did not distinguish between those with and without DS
2) studies which focused on the population with DS;
3) studies which focused on the ID population who do not have Down syndrome (non-DS ID).

The reviewed studies varied considerably in the population studied, in the design of the study, and in the size of the population studied. Some included only institutionalized participants, but the majority were population-based studies, which involved individuals living in community settings as well as in institutions (see tables 1 & 2). Studies that included only institutionalized samples may have been biased as people living in long-term facilities are usually more severely disabled.

The majority of studies were conducted in Europe (the Netherlands, Ireland, and UK in particular) and the US. There was only one published study from Asia, and none from South America, Eastern Europe, Africa or Australasia. The variation in the size of the study samples as well as the sample selection methods may explain some of the diversity observed in the findings. In most of the studies reviewed, well-accepted criteria for the diagnosis of dementia in adult population with ID were used, though those criteria differed between studies. Different criteria

may result in diagnosing different cases (see assessment and diagnosis section of this paper). The ascertainment and assessment of cases also differed. Studies that made direct assessment of participants and included information given by caregivers as well as medical records are likely to have the most reliable estimates of prevalence and incidence. Studies that relied solely on third party report of diagnoses or symptoms may have under-estimated dementia, (e.g. Janicki & Dalton, 2000; Van Schrojenstein Lantman de Valk, Van den Akker, Maaskant, & Haveman, 1997). A few prevalence studies were able to confirm diagnoses with cross-sectional assessments, (e.g. Zigman, et al., 2004), while others were entirely cross-sectional. Given the methodological differences among the studies conducted, it is difficult to do direct comparison of findings. We have acknowledged the methodological differences when comparing the estimated rates of dementia across different studies.

Dementia Prevalence

Dementia prevalence among population with ID

A few studies have reported estimates of population-based prevalence of dementia in an overall population of persons with ID. Janicki and Dalton (2000) conducted the most recent study in the New York State, USA, based on a postal survey of known dementia cases amongst adults using ID services – individual assessments were not undertaken. The overall prevalence rate (6.1% in those aged 60 and older) was comparable to that in the general population. Among adults with Down syndrome, the rates were higher - 22% for those aged 40+ and 56% for those aged 60 and older. The mean age of dementia onset among individuals with Down syndrome was 52.8 years. For individuals with other types of ID it was 67.2 years (Janicki & Dalton, 2000).

Dementia prevalence among the population with Down syndrome

The majority of the prevalence studies we found have focused on adults with DS (table 1). Several of these studies were representative surveys, which included adults from community as well as institutional settings. Often, the sampling frame was the entire DS population of an area or district (Coppus, et al., 2006; Holland, Hon, Huppert, Stevens, & Watson, 1998). These studies confirmed that dementia is common in older adults with DS, and that the prevalence increases sharply from the age of 40 until the age 60. For example, in the UK, using CAMDEX criteria for Alzheimer's disease prevalence rates increased from 3.4% to 10.3% to 40% among 30-39, 40-49 and 50-59 age groups, respectively (Holland, et al., 1998). In Ireland, using modified DSM-IVcriteria to diagnose cases, age-specific prevalence rates were as follows: 1.4% for those under age 40; 5.7% for those 40-49 years of age; 30.4% for those 50-59 years of age (Tyrrell, et al., 2001). The largest representative study of dementia in the DS population to date was in the Netherlands, based on the total population of one province and included 506 participants with DS

aged 45 years and older (Coppus, et al., 2006). Up to the age of 60, the prevalence of dementia doubled with each 5-year interval. Up to the age of 49, the prevalence was 9%; between the ages of 50 and 54, 17.7%; between 55 and 59, it was estimated at 32.1%.

There was considerable variation between studies for the prevalence of dementia beyond the age of 60. Tyrrell and associates (2001) described a rate of 41.7% among those aged 60 and over, and 50% among those aged 70 or older; while Coppus et al. (2006) described a decrease in prevalence to 25.6% beyond age 60, thought to be due to either a decline in incidence, or an increase in mortality rate in those with dementia (Coppus, et al., 2006; Tyrrell, et al., 2001). One other study, based on an institutional sample, described a rate of 100% in adults with DS aged 65 and older (Visser, Aldenkamp, Van Huffelen, & Kuilman, 1997).

No gender differences have been found for dementia rates in older adults with DS (Coppus, et al., 2006; Tyrrell, et al., 2001), but the average age of menopause of women with DS was younger than in the general population, and the age at onset of dementia was correlated with the age of menopause for those who developed dementia (Cosgrave, Tyrrell, McCarron, Gill, & Lawlor, 1999).

Dementia prevalence among population with non-DS ID

Only a few studies focused on the prevalence and/or incidence among adults with ID who do not have Down syndrome. Two studies have been undertaken in the UK (table 1). Cooper (1997) conducted a population-based study of 134 elderly people with ID over the age of 65 (five of whom had DS). Dementia was diagnosed in 21.6% which was substantially higher than that found in the general population (Cooper, 1997). Strydom and associates (2007) established a representative sample of 222 urban adults with ID aged 60 and older. Dementia cases were identified after a two-phased process – a screening phase, followed by comprehensive assessment of screen positives. Using ICD-10, DSM-IV, DC-LD and dementia subtype criteria, the overall dementia prevalence was 13.1% (95% CI 8.9-18.2) among those aged 60 and older, and 18.3% (95% CI 12.3-25.7) among those aged 65 and older. Alzheimer's disease was the most common type, and had a prevalence rate of 12% (7.1 – 18.5%) among those aged 65 and older, three times greater than general population rates. Lewy body and fronto-temporal dementias were, interestingly, more common than vascular dementia.

Zigman et al. (2004) conducted a longitudinal study of 126 adults with ID without DS over the age of 65 in the USA. The sample consisted of a random selection of registered users of ID services, supplemented with a convenience sample and the authors employed comprehensive assessments. They identified 10 cases with possible, definite or complicated AD (prevalence rate 9% for those aged 65 and older; 12% for those 75 years and older). These rates were within the range of rates for adults without ID (Zigman, et al., 2004).

The difference in prevalence rates between the UK and US may be explained by the

methodology. Although the UK estimates were based on samples representative of service users, the diagnoses were based on a single evaluation rather than on longitudinal assessments, and this may have over-estimated dementia. The American study may have under-estimated dementia by not including all dementia subtypes, by using more restrictive criteria, or by being less representative than the UK studies (it included a convenience sample). However, like-for-like estimates for AD prevalence according to ICD-10 criteria were similar in the UK and USA (Strydom, Livingston, King, & Hassiotis, 2007; Zigman, et al., 2004).

Dementia Incidence

In dementia incidence studies, it is important to consider the age distribution of the cohort, the rigor with which dementia cases at entry are excluded, the length of follow-up and the diagnostic methods and criteria used.

Dementia Incidence among the population with Down syndrome

The majority of reviewed studies were of cohorts of individuals with DS, summarized in table (2). For example, Visser et al. (1997) described the dementia incidence over a 6 year period among 307 institutionalized participants in the Netherlands. Among those aged 40 years and above at entry, the incidence rate was 36%. Incidence increased steadily with increasing age, and did not appear to taper off in those aged 60 and older (Coppus, et al., 2006). Decreased prevalence in adults with DS aged 60 and older noted in this study therefore appeared to be due to an increase in mortality of those with dementia, which was more than twice that of those without dementia.

The survival period from onset of dementia at age 55 until death was 3.5 years (SD 2.2) for incident cases in an institutional sample of more severely disabled adults (Margallo-Lana, et al., 2007), while the mean age at death was 59.3 (SD 10.2) years. In this study, the incidence rate of dementia was 25% over 15 years, which seems to be low compared to other studies, possibly due to the difficulties in diagnosing dementia in those with profound ID. However, the study was unusual in that neuropathological findings were available for many of those that had died – dementia diagnosis was associated with the density of tangles, but not plaques.

Dementia incidence among population with non-DS ID

Zigman and colleagues (2004) also reported incidence rates from their longitudinal study of adults with ID without Down syndrome over the age of 65, though the sample size was reduced in each subsequent wave of data collection. The incidence rate for AD was 3.1 per 100 person years (Zigman, et al., 2004).

Dementia in specific ID syndromes other than DS

Although we have found several studies describing Fragile X-associated Tremor/Ataxia Syndrome (FXTAS), a disorder characterized by progressive action tremor, ataxia and dementia that occurs in premutation carriers of the FMR1 (fragile X mental retardation 1) gene (Hagerman & Hagerman, 2004), we did not include it in this review because FXTAS itself is not associated with ID. Little attention has been paid to the risk of dementia in other specific ID syndromes. We have summarized in table 3 the common syndromes which have been associated with development to adulthood. Although these adults often have reduced life expectancy, many reach middle age and could therefore develop dementia.

Several syndromes have "dementia" as a common characteristic – these include Cockayne syndrome, Rett syndrome and Sanfilippo syndrome. Cockayne syndrome (Progeria-Like-Syndrome), a rare autosomal recessive disorder, is characterized by premature ageing, including dementia (Rapin, et al., 2006).

Rett syndrome

Rett syndrome is a childhood neurodevelopmental disorder which manifests particular symptoms at certain ages. The general Rett profile is that of a slow deterioration of gross motor performance over the years in contrast with a relatively preserved cognitive ability to communicate, mainly with the eyes. The condition stabilizes to some extent after childhood, but many of the women with this disorder now live into old age with progressive neuromuscular problems (Hagberg, 2005; Halbach, et al., 2008). Occurring almost exclusively in girls, it is believed to be due to a mutation in the MECP2 gene on chromosome X, a transcriptional repressor presumed to be essential for neuronal function of the maturing brain (Van den Veyver & Zoghbi, 2002). Rett syndrome was initially described as being a progressive syndrome of autism, dementia, ataxia and loss of purposeful hand use in girls (Hagberg, Aicardi, Dias, & Ramos, 1983). There is now doubt about the progressive nature of the disorder and whether the term "dementia" should be used to describe the deterioration. Because of various functional, physical, anatomic and chemical features, it has been hypothesized that Rett syndrome could be a disorder of development (Einspieler, Kerr, & Prechtl, 2005).

Sanfilippo syndrome

The Sanfilippo syndrome, or mucopolysaccharidosis III (MPS III), is a lysosomal storage disease due to impaired degradation of heparan sulfate and includes 4 types, each due to the deficiency of a different enzyme: heparan N-sulfatase (type A); alpha-N-acetylglucosaminidase (type B); acetyl CoA:alpha-glucosaminide acetyltransferase (type C); and N-acetylglucosamine 6-sulfatase (type D) (Yogalingam & Hopwood, 2001). The Sanfilippo syndrome is characterized by severe central nervous system degeneration, but only mild somatic disease. Onset of clinical

features usually occurs between 2 and 6 years; severe neurological degeneration occurs in most patients between 6 and 10 years of age, and death occurs typically during the second or third decade of life. Type A has been reported to be the most severe, with earlier onset and rapid progression of symptoms and shorter survival; in type B, patients survive into midlife. A Dutch study showed that 18/20 of adults (aged 20-76 years) with Sanfilippo syndrome had dementia (Moog, et al., 2007). Another study, which included some of the same individuals as the previous study, showed that 17/29 of individuals (aged 7-72 years) had dementia (Skandar, Schoonbrood-Lenssen, Van den Akker, & Maaskant, 2005).

Other syndromes

Although we did not find any papers describing dementia cases in Williams syndrome (associated with a microdeletion of the long arm of chromosome 7), a group of researchers followed a number of adults with detailed psychometric assessments, and found the syndrome to be associated with precocious ageing and loss of some cognitive abilities, specifically explicit memory functions (Krinsky-McHale, Kittler, Brown, Jenkins, & Devenny, 2005). Lastly, a study on Prader-Willi syndrome (in most cases due to a deletion on chromosome 15) found no dementia cases in a cohort of 74 individuals aged 18-63 years (Sinnema, Maaskant, Van Schrojenstein Lantman-de Valk, Schrander-Stumpel, & Curfs, 2008).

Table 1 Age-related Prevalence of Dementia in Intellectual Disabilities (ID) (DS and non-DS)

Authors (year)	Study Design	Location	Residence	Sample	Dementia Criteria	Age	Overall Prevalence (%)	Age-specific Prevalence (%)
Overall ID population								
Janicki & Dalton, 2000	Cross-sectional	New York State, US	Institution and community	Overall ID Dementia cases = 794 DS dementia cases = 268	Postal survey of ID services; did not use specific diagnostic criteria	40+ 60+ 80+ 40+ 60+		3.0 6.1 12.1 22.1 56.4
Van Schrojenstein Lantman de Valk, et al., 1997	Longitudinal	The Netherlands	Institution and community homes	overall ID n = 1020 DS n = 243 Non-DS ID =	Questionnaires to General Practitioners; no assessments completed with participants; criteria used not known	All ages 0-19 20-29 30-39 40-49 50-59 60-69 >70 0-19 20-29 30-39 40-49 50-59 ≥60 All ages	3.8 16.9 2.0	 1.0 - 0.8 5.1 5.4 6.2 17.6 - - - 22.2 45.7 72.7

				849		0-19 20-29 30-39 40-49 50-59 ≥60		1.3 - 1.1 - 1.7 5.9
Age-related Prevalence of Dementia in Down syndrome (DS)								
Coppus, et al., 2006	Longitudinal study	The Netherlands	Community & Institution	506	Possible cases identified by informants, who were clinically assessed; diagnosed by ICD-10	45+ 45-49 50-54 55-59 60+	16.8 (16-23)	- 8.9 (95% CI 5-12) 17.7 (95% CI 12-23) 32.1 (95% CI 22-42) 25.6 (95% CI 12-40)
Tyrrell, et al., 2001	Cross-sectional	Ireland	Community & Institution	285	Clinical assessment of all participants DSM IV	35+ 35-40 40-49 50-59 60+ 70+	13.3	 1.4 5.7 30.4 41.7 50.0
Van Buggenhout, et al., 1999	Cross-sectional	The Netherlands	Institution	96	Psychometric and medical assessment; criteria not known	50+	42.4	
Holland, et al., 1998	Cross-sectional	UK	Community & Institution	75	Psychometric assessment & informant interview. ICD-10; DSM IV, CAMDEX-AD, DLB and FTD criteria	30+ 30-39 40-49 50-59 30+	24.0 (All dementias) 13.3 (CAMDEX AD)	 20.7 20.7 40.0

						30-39 40-49 50-59		3.4 10.3 40.0
Sekijima, et al., 1998	Longitudinal assessment (1 year)	Japan	Institution	106	Clinical assessment CT scanning; Criteria not specified	30+ 30-39 40-49 50+	15.1	 0.0 16.0 41.0
Visser, et al., 1997	Longitudinal	The Netherlands	Institution	307	Clinical assessment & EEG; criteria not specified	All ages <39 40-49 50-59 60-69 >70	18%	 0.0 11.0 66.0 77.0 100.0
Age-related Prevalence of Dementia in non-DS ID								
Cooper, 1997	Cross-sectional	UK	Community Institution	134	Clinical assessment ICD-10 dementia	65+ 65-74 75-84 85-94	21.6	- 15.6 23.5 70.0
Zigman, et al., 2004	Longitudinal	New York State, USA	Community Institution	126	Psychometric and clinical assessments. DSM-IV AD criteria possible/definite AD or "uncertain with complications"	 65+ 75+		 9.0 (95% CI 4.2-16.4) 12.1 (95% CI 5.0-23.3)
Strydom, et al., 2007	Cross-sectional	UK	Community (urban)	222	Screening and detailed clinical assessment ICD-10, DSM-IV, or DC-LD			

					Any dementia AD on any criteria VaD on any criteria DLB on any criteria FTD on any criteria	60+ 65+ 65+ 65+ 65+ 65+	13.1 18.3	 12.0 (95% CI 7.1-18.5) 3.5 (95% CI 1.2-8.0) 7.7 (95% CI 3.9-13.4) 4.2 (95% CI 1.6-9.0)

Table 2 Incidence of dementia in ID

Authors (year)	Study Design	Location	Residence	Sample	Dementia Criteria	Age	Follow-up (Yrs)	# of Incident Cases	Incidence
Overall ID population									
Van Schrojenstein Lantman-de Valk et al. 1997	Longitudinal	The Netherlands	Institution and community homes		Questionnaires to General Practitioners; no assessments completed with participants; criteria used not known	All ages	3		% 2.7
				All 1041 (DS and non-DS)		30-39 40-49 50-59 ≥60			0.5 5.6 2.9 5.7
				214 DS		30-39 40-49 50-59 ≥60			0.0 24.0 27.6 80.0
				827 non-DS ID		30-39 40-49 50-59 ≥60			0.6 0.0 1.5 5.1

Incidence of dementia in Down syndrome									
Margallo-Lana, et al., 2007	Longitudinal	UK	Institution	92	Sequential clinical assessment ICD10 Neuropathology	38 (Median age at start)	15 years	18	25% over 15 years
Coppus et al. 2006	Longitudinal	The Netherlands	Institution Community	506	ICD-10	<50 50-54 55-59 ≥60	Mean 3.3 years	18 14 8 9	Per 100 person years 2.5 2.8 4.9 13.3
Holland, Hon, Huppert, & Stevens, 2000	Longitudinal	UK	Community Institution	68	Psychometric assessment & informant interview. ICD-10; DSM IV, CAMDEX-AD, DLB and FTD criteria	30+ 30-39 40-49 50-59	18 months	13 6 5 2	% 24.5 26.1 26.3 22.2
Incidence of dementia in non-DS ID									
Evenhuis, 1997	Retrospective Follow-up study	The Netherlands	Institution	144	DSM-III-R	60+ 60-69 70-79 ≥80	11	1 5 3	% 1.6 (0.0-4.7) 19.1 (2.4-35.8) 29.1 (0.0-62.1)
Zigman et al. 2004	Longitudinal	New York State, USA	Community Institution	100(	DSM-IV (AD only) possible/ definite dementia or “uncertain with complications”	65-84	3	8	Per 100 person years 3.1

Table 3 Specific syndromes: life expectancy and dementia.

Syndrome	Cause	Life Expectancy (LE)	Dementia
Angelman	Most: deletion chromosome 15	Reaching adulthood; Reduced LE (<10-15 years) (Angelman-syndrome -Foundation, Williams, Philips, & Wagstaff, 2008)	N=1 (case-study) (Bjerre, Fagher, Ryding, & Rosen, 1984)
Coffin Lowry	Most: mutation X-chromosome	Reaching adulthood, Reduced LE (Hunter, 2002)	-
Cornelia de Lange	Most: mutation chromosome 5	Reaching adulthood; Reduced LE (Begeman & Duggan, 1976; The-Cornelia-de-Lange-syndrome -Association, 2008)	-
Cri du Chat	Deletion chromosome 5	Reaching adulthood; Reduced LE (Mainardi, et al., 2006)	-
Fragile X	Mutation X-chromosome	Reaching adulthood; Reduced LE (-10 y) (Partington, Robinson, Laing, & Turner, 1992)	-
Kabuki	Unknown	Reaching adulthood; Normal LE (?) (Kabuki-Syndrome -Network, 2008)	-
Klinefelter	Extra X-chromosome	Slightly reduced LE (2 y) (Bojesen, Juul, Birkebaek, & Gravholt, 2004; Swerdlow, Higgins, Schoemaker, Wright, & Jacobs, 2005)	-
Laurence Moon Bardet Biedl	Most: mutation chromosome 11	Reaching adulthood; Reduced LE (Riise, 1996)	-
Prader Willi	Most deletion chromosome 15	Reported sudden deaths; Reaching adulthood; Reduced LE (?) (Einfeld, et al., 2006)	0/74 (Sinnema, et al., 2008)
Rett	Mutation *X*-chromosome	Reported sudden deaths; Reaching adulthood (Guideri & Acampa, 2005; Laurvick, et al., 2006)	See text
Rubinstein Taybi	Most: mutation	Reaching adulthood; Reduced LE (Mijuskovic, Karadaglic,	-

	chromosome 16	& Stojanov, 2006)	
Sanfilippo	A: mutation chr 17 B: mutation chr 17 C: mutation chr 8 D: mutation chr 12	Reaching adulthood; Reduced LE (see text)	18/20 (Moog, et al., 2007) 17/29 (Skandar, et al., 2005)
Sotos	Mutation chromosome 5	Expected Normal LE (National Institute of Neurological-Disorders and Stroke, 2007)	-
Velocardiofacial syndrome	Deletion chromosome 22	Reaching adulthood	N=1, case- study (Evers, Vermaak, Engelen, & Curfs, 2006)
Williams	Deletion chromosome 7	Reported sudden deaths but reaching adulthood (Bird, et al., 1996; Wessel, et al., 2004)	See text
Wolf-Hirschhorn	Deletion chromosome 4	Reaching adulthood; Reduced LE (Shannon, Maltby, Rigby, & Quarrell, 2001)	-

Presentation of dementia in adults with ID

A discussion of the presentation of dementia in ID is complicated by several issues. The first is that studies of dementia in this population rarely make a distinction between dementia subtypes. Secondly, dementia presentation may differ between people according to the severity of pre-existing ID. Lastly, it is also important to distinguish the presentation of dementia in subgroups such as those with DS, because their unique cognitive profile and biological characteristics may be influential (Teipel & Hampel, 2006). We have therefore focused on aspects of dementia presentation specific to adults with DS separately from other adults with ID.

Dementia symptoms in adults with DS

Table 4 includes studies that have examined the presentation of dementia by observing the development of symptoms over time (longitudinal studies), or by making comparisons between those with and without dementia (cross-sectional studies).

Trigger symptoms in people with DS

Recent studies have continued the work of earlier authors e.g. Evenhuis, (1990) to describe the “trigger” symptoms associated with diagnosis of dementia in DS. Common symptoms included memory loss and deterioration in speech, personality and behavioural changes, disorientation, and functional deterioration (Cosgrave, Tyrrell, McCarron, Gill, & Lawlor, 2000; Visser, et al., 1997). Up to half of the cases presented with neurological symptoms, such as seizures and incontinence which are normally signs of advanced disease, suggesting that dementia presents atypically in DS, or reflecting the diagnostic difficulties, particularly in those with more severe ID. Deb et al. (2007) made a qualitative summary of caregivers’ reports of early symptoms. Forgetfulness and confusion were the most prominent symptoms but many 'frontal lobe'-related symptoms that are usually manifest later in the course of dementia among the general population, were also common. These included slowness in activities and speech, loss of interest and withdrawal, along with the emergence of emotional and behaviour problems (Deb, Hare, & Prior, 2007).

Memory and other cognitive changes in people with DS

Several researchers have used sequential cognitive assessments to track the changes that occur with the development of dementia in adults with DS. Similar to AD in the general population, memory change appears to be an early symptom in DS and is present before the persons meet the full clinical criteria for dementia (Devenny, Krinsky-Mchale, Sersen, & Silverman, 2000; Devenny, Zimmerli, Kittler, & Krinsky-Mchale, 2002; Krinsky-Mchale, Devenny, & Silverman, 2002). Cognitive decline associated with early and middle stage dementia involved

progressively more areas of cognitive functioning, starting with complex cognitive functions, followed by visual organization as well as verbal memory before affecting semantic and short-term memory (Devenny, et al., 2000).

These results are in keeping with other studies that have demonstrated that the diagnosis of dementia was associated with early deficits on both memory and executive functioning tasks (Ball, Holland, Treppner, Watson, & Huppert, 2008; Kittler, Krinsky-McHale, & Devenny, 2006) though it is not clear whether these develop together or sequentially. Dyspraxia occurs at a later stage (Crayton, Oliver, Holland, Bradbury, & Hall, 1998; Dalton, Mehta, Fedor, & Patti, 1999).

Functional, personality or behavioural changes

Many studies have sought caregiver reports on the presentation of dementia, often out of necessity, given the ability profile of many adults with DS. Cosgrave et al. (2000) described decline in activities of daily living (ADL) as a trigger symptom in 48% of their dementia cases, which progressed from deterioration in personal hygiene to housekeeping skills and spatial orientation (Cosgrave, et al., 2000; Prasher, Chung, & Haque, 1998). These continued to deteriorate with progression until it floored, with dressing, spatial orientation and eating being last to floor.

Several studies have confirmed earlier reports of prominent personality and behavioural change in those with DS and dementia (Lai & Williams, 1989); these appear to be a harbinger of the disorder in adults with DS (Ball, et al., 2006; Holland, et al., 2000; Nelson, Orme, Osann, & Lott, 2001). Ball et al. (2006) made the interesting observation that many older adults with DS meet criteria for dementia of frontal type, which the authors described as a preclinical stage of AD, before they progress to meeting the criteria for AD, and also showed that personality change is associated with executive dysfunction (Ball, et al., 2006; Ball, et al., 2008). Individuals with dementia displayed increased and more severe maladaptive behaviours (Prasher, et al., 1998; Urv, Zigman, & Silverman, 2008), which can be divided into two types – behavioural excesses such as irritability, aggression or self-abusive behaviour, or behavioural deficits such as general slowness, apathy or loss of interest and decreased social engagement (Cosgrave, et al., 1999; Deb, Hare, & Prior, 2007; Huxley, Van Schaik, & Witts, 2005; Urv, et al., 2008). Behavioural excesses rather than deficits triggered referral for dementia assessment (Adams, et al., 2008). This has important implications - many older adults with DS may have dementia symptoms but do not get assessed until their behaviour becomes troublesome to their caregivers.

One study compared the behavioural and emotional changes associated with AD between 30 individuals with DS and AD, and 30 individuals with AD from the general population (Temple & Konstantareas, 2005). The DS group experienced fewer delusions and problem behaviours overall but was more physically active compared to the AD-only individuals.

Neurological and other physical findings

Epilepsy and myoclonus is often associated with dementia in DS, especially in those with severe ID (Cosgrave, et al., 2000; Margallo-Lana, et al., 2007; Tyrrell, et al., 2001; Visser, et al., 1997). Late onset myoclonic epilepsy in DS (LOMEDS) is characterized by myoclonic jerks on awakening, generalized tonic-clonic seizures, and generalized spike and wave on EEG; an interesting observation is that AD and progressive myoclonic epilepsy are both linked to chromosome 21 (Menendez, 2005). Pathological reflexes such as grasping and sucking reflexes and concomitant atrophy on neuro-imaging was shown to be significantly related to behavioural changes associated with frontal lobe problems (Nelson, et al., 2001). This ties in nicely with the hypothesis that frontal dysfunction is a prominent feature of dementia in DS. Other common neurological symptoms have included rigidity and postural abnormalities (Margallo-Lana, et al., 2007).

Those with dementia have more health co-morbidities than those without (McCarron, et al., 2005) especially lung disease, gastro-intestinal disorders, visual and hearing impairments; and often lose weight (Prasher, Metseagharun, & Haque, 2004). This might be due to dysphagia or other factors such as loss of appetite, difficulty with feeding, malabsorption, and concomitant medical conditions (Lazenby, 2008). Some may require tube feeding as their condition deteriorates (McCarron, et al., 2005).

End-stage symptoms

Cosgrave et al. (2000) and Visser et al. (1997) have described 14 and 41 subjects respectively with end stage dementia. All were unresponsive to their environment and lost the ability to speak. They were totally dependent and unable to walk, all were incontinent, and almost all had seizures and many had Parkinsonian features.

Dementia presentation in older adults with non-DS ID

The most common presenting symptoms of dementia in older adults with non-DS ID were reported by caregivers in a UK study with 26 dementia cases to be general deterioration in functioning (50%), followed by behavioural or emotional change (15%). Deterioration in memory and other cognitive functions were less prominent in the early stages of the disorder (Strydom, et al., 2007). Other signs include symptoms of depression such as lack of energy, low mood and disturbed sleep, persecutory delusions and auditory hallucinations, or delirium; while late stage symptoms such as urinary incontinence, difficulty in walking and fecal incontinence were surprisingly common (Cooper & Prasher, 1998; Evenhuis, 1997). Compared to those with DS and dementia, aggression occurred with greater frequency in those with non-DS ID, but the DS cases had a higher prevalence of other behavioural changes (Cooper & Prasher, 1998).

Table 4 Studies of the presentation of dementia in DS since 1997

Authors	Number & age of participants	Type of study	Presentation under study	Main findings
Visser, et al., 1997	N = 307, age 10 – 72; 56 had dementia	Longitudinal	Onset and progression of symptoms	Initial onset was non-specific (loss of interest, motivation etc.). See text for end stage symptoms
Prasher, et al., 1998	N = 128, age 16 – 72; 17 had dementia	Longitudinal	Adaptive behaviour	Functional decline strongly associated with dementia
Cosgrave, et al., 1999	N = 128, mean age 49; 30 had dementia	Cross-sectional	Adaptive and maladaptive behaviour	Increased self-abusive behaviour and decreased social engagement predicted by dementia
Cosgrave, et al., 2000	N = 80, females only, age 35 – 71; 35 had dementia	Longitudinal	Adaptive behaviour & cognitive symptoms	Identified trigger symptoms and symptoms associated with progression (see text)
Devenny, et al., 2000	N = 66, mean age 53; 10 with cognitive decline and 12 with dementia	Longitudinal	Sequence of cognitive decline	Memory decline predominant, with progressive involvement of other cognitive functions
Nelson, et al., 2001	N = 26, mean age 40 (9 classified as “probable dementia”)	Longitudinal	Neurological abnormalities, emotional and cognitive symptoms; neuro-imaging	Brain atrophy on MRI and abnormal frontal reflexes associated with emotional and cognitive symptoms
Puri, Ho, & Singh, 2001	N = 68, age 29 – 83 (?n with AD)	Unknown	Epilepsy	Late onset but not young onset epilepsy associated with dementia
Tyrrell, et al., 2001	N = 285, age 35-74; 38 with dementia	Cross-sectional	Clinical characteristics	Dementia associated with onset of epilepsy (OR = 9.6) & myoclonus
Devenny, et al., 2002	N = 94, mean age 55; 19 with dementia	Longitudinal	Memory; cognitive assessment	Memory decline present several years before dementia diagnosis
Krinsky-Mchale, et al., 2002	N = 85, 14 had dementia	Longitudinal	Memory and cognition	Verbal explicit memory deficits demonstrated in early dementia
Prasher, et al., 2004	N = 48, age 41-60; 24 with dementia	Longitudinal	Body weight; physical assessment	Ageing associated with weight loss; more if dementia
Huxley, et al., 2005	N = 34, mean age 53; 15 diagnosed with dementia	Cross-sectional	Maladaptive behaviour	More frequent and severe behaviour problems in dementia
Ball, et al., 2006	N = 55, age 37 - 72; 10 had dementia	Longitudinal	Personality or behaviour & cognitive change	Behaviour changes and executive dysfunction occur early
Deb, Hare, & Prior,	24 caregivers of adults with	Qualitative study	Caregiver report of early	See text

2007	DS and dementia		symptoms of dementia	
Margallo-Lana, et al., 2007	N = 92, median age 38 at entry; 18 incident cases	Longitudinal (15 years)	Caregiver report and cognitive assessment	Neurological signs are common; neuropathological findings
Ball, et al., 2008	N = 103, aged 36 – 72; 25 had dementia	Cross-sectional	Executive dysfunction, memory and personality change	Informant reported personality changes accords with executive function deficits
Urv, et al., 2008	N = 251, age 45 and older; 38 with dementia	Longitudinal	Maladaptive behaviour	See text

Screening for dementia in adults with ID

Screening tests have to be brief and easy to perform, inexpensive, and acceptable to individuals, in addition to having good psychometric and diagnostic properties. A review of the screening tools for dementia in adults with ID identified two types of tests: those completed by or with caregivers, and those that rely on direct assessment of the individual (Strydom & Hassiotis, 2003). Both types of tests can discriminate dementia in this population (Shultz, et al., 2004).

Screening tools completed by or with caregivers

Screening tools completed by or with caregivers are limited by reliability of informants, and recall bias may be a problem. Nevertheless, informant history is essential to diagnose dementia in adults with ID, given their communication and memory difficulties. Good agreement between informant ratings and direct assessment is possible (Burt, et al., 1999). The Dementia questionnaire for persons with Mental Retardation (DMR) is an example of a test based on caregiver report, now widely in use (Evenhuis, 1996). However, a comparative study with cross-sectional as well as sequential assessments showed low agreement with physician or psychologist diagnoses (Hoekman & Maaskant, 2002) and the latest version of the tool only includes threshold scores for sequential assessment. The Dementia Scale for Down syndrome (DSDS) (Gedye, 1995) was shown to be more reliable (Burt, et al., 2005b), and the Dutch revised version showed high agreements between the DSDS diagnosis compared to physician or psychologist diagnosis (Maaskant, et al., 2008).

The Adaptive Behaviour Dementia Questionnaire (ABDQ) is a simple 15-item screening tool based on rating of functional decline and other symptoms of dementia which has good reliability and validity. Sensitivity to detect AD was 89%, and specificity 94%. The positive predictive value was 89% and the negative predictive value 94%, with an overall accuracy of 92% in adults with DS (Prasher, Farooq, & Holder, 2004).

A similar tool, the Dementia Screening Questionnaire for Individuals with Intellectual Disabilities (DSQIID) was also evaluated in adults with DS and had sound internal consistency, excellent test-retest and interrater reliability, sensitivity of 92%, and specificity of 97% (Deb, Hare, Prior, & Bhaumik, 2007). A positive test result (indicating dementia) was 31 times more likely and a negative test result (no dementia) was 13 times less likely in a person with dementia than without dementia (Parmenter, 2008).

Screening based on individual performance

Tests based on the performance of individuals e.g. the Mini-mental state examination (MMSE) (Folstein, Folstein, & McHugh, 1975) are used to screen for dementia in the general population, but are difficult to apply in the ID population due to varying ability - an MMSE could be

performed in only 55% of subjects with DS (Deb & Braganza, 1999). This may be overcome by referencing quantitative criteria to IQs established earlier in adulthood, in order to identify individuals with dementia based upon assessment at a single point in time (Silverman, et al., 2004). However, many adults with ID may never have had IQ tests and those with less ability may not be able to complete tests (floor effects). Nevertheless, several tests have been adapted for the ID population, including the Test for Severe Impairment (TSI) (Cosgrave, et al., 1998); Severe Impairment Battery (SIB) (McKenzie, et al., 2002; Witts & Elders, 1998); IBR mental status examination (Silverman, et al., 2004); Delayed Match-to-Sample test (Dalton & McMurray, 1995; Dalton, et al., 1999) and a Brief Praxis test (Sano, Aisen, Dalton, Andrews, & Tsai, 2005) but threshold scores for single applications has not been established, and at present, these tools are best used in sequential assessment rather than screening.

Combined approaches

After Hoekman and Maaskant (2002) demonstrated unsatisfactory agreements with clinical diagnoses for the DMR, CLD (Checklist with Symptoms of Dementia; Visser, et al., 1997) or the Delayed Match-to-Sample test, Silverman et al. (2004) investigated the utility of using a combined caregiver rating and performance rating strategy. Both tests (DMR Cognitive Scores and the IBR Mental Status Examination) were IQ referenced. Where individuals were classified as having dementia if either of the tests were positive, sensitivity was improved to 100% at the cost of specificity (70%) (Silverman, et al., 2004). Screening strategies that combine caregiver and performance rated tools may therefore improve identification of cases.

Comprehensive assessment

Comprehensive neuropsychological and neurological assessment of suspected dementia cases contributes to diagnosis and sub-typing, describing cognitive deficits in order to plan care, and can track progression and response to interventions. Both performance measures and caregiver-rated tools have been used for detailed assessment of cognitive and behavioural changes associated with dementia (Burt & Aylward, 2000).

Caregiver rated tools

Ball et al. (2006) modified the Cambridge Examination for Mental Disorders of the Elderly (CAMDEX) informant interview for use with adults with DS, which provides structured information about dementia symptoms, including memory and other cognitive functions, personality and behavioural changes as well as the relevant medical and family history. The CAMDEX-DS had good concurrent validity and inter-rater reliability (Ball, et al., 2006). The Multidimensional Observation Scale for Elderly Subjects (MOSES) collects information from informants about behavioural changes in ageing persons with ID (Dalton, Fedor, Patti, Tsiouris, & Mehta, 2002). It

has a three-factor structure corresponding to adaptive behaviour, externalizing and internalizing maladaptive behaviours (Sturmey, Tsiouris, & Patti, 2003).

Detailed assessment of performance

Detailed neuropsychological assessments usually consist of a battery of tests for use in clinics, cohort studies or clinical trials (Burt & Aylward, 2000; Crayton, et al., 1998; Devenny, et al., 2000; Johansson & Terenius, 2002; Palmer, 2006; Sano, et al., 2005). Brief tests adapted for the ID population include the Severe Impairment Battery (SIB) (McKenzie, et al., 2002; Witts & Elders, 1998); Dementia rating scale (DRS) (McDaniel & McLaughlin, 2000); CAMCOG-DS (Hon, Huppert, Holland, & Watson, 1999), Test for Severe Impairment (TSI) (Cosgrave, et al., 1998), IBR mental status examination (Silverman, et al., 2004) and the "Shultz" Mini-Mental Status Exam (Shultz, et al., 2004). While these tools may differ in their individual characteristics (e.g. the TSI has few memory items), they all share to some extent the problem of floor effects in those with more severe disabilities (Deb & Braganza, 1999; Hon, et al., 1999). For such adults, tests developed for animal studies may be less prone to floor effects (Nelson, et al., 2005; Nelson, Scheibel, Ringman, & Sayre, 2007).

Assessment tools for specific cognitive abilities include tests of dyspraxia (Dyspraxia scale; and Brief Praxis Test) which has good psychometric properties (Dalton & Fedor, 1998; Dalton, et al., 1999; Sano, et al., 2005); several memory tests e.g. autobiographical memory and orientation (Pyo, Kripakaran, Curtis, Curtis, & Markwell, 2007), the Rivermead behavioural memory test (Hon, Huppert, Holland, & Watson, 1998), the cued recall test (Devenny, et al., 2002), and the delayed match-to-sample test (Dalton, et al., 1999); as well as tests of verbal fluency, executive functioning, and verbal abilities (Ball, et al., 2008; Burt, et al., 2005b; Sano, et al., 2005).

Neuroimaging and EEG

Although abnormalities were commonly found in a case series of older adults with ID and decline referred for neuroimaging to rule out treatable conditions, it only affected the management plan in a few (Gangadharan & Bhaumik, 2006) and the level of sedation required to enable participants with DS to go through with MRI scans may be dangerous (Prasher, et al., 2003). Although structural abnormalities associated with AD can be shown in adults with DS these could not be used to accurately diagnose AD (Prasher, et al., 2003) due to the pre-morbid features of the brains of people with DS (Teipel & Hampel, 2006). EEG is not useful as a dementia diagnostic tool either. Although EEG changes can be shown with dementia progression in DS (Visser, et al., 1997), it cannot be distinguished from other abnormalities (Medaglini, Locatelli, Fornara, & Alberoni, 1997). Nevertheless, EEG may be required to exclude atypical presentations of epilepsy (Tomka, Huber, & Seidel, 2004).

Differential diagnosis

Delirium is an exclusion criterion common to most diagnostic criteria for dementia and is associated with surgery, anticholinergic drugs, infection, and Alzheimer's disease in the ID population, though often overlooked (Van Waarde & Van der Mast, 2004). Other physical disorders and medication effects that might present like dementia or worsen the symptoms of dementia include sensory deficits (Margallo-Lana, et al., 2007), atypical epilepsy (Tomka, et al., 2004), thyroid disorder (Kalsy, et al., 2005) anticholinergics (Hassiotis, Strydom, Allen, & Walker, 2003) and phenytoin (Tsiouris, Patti, Tipu, & Raguthu, 2002).

Mental illness such as depression is also an important differential diagnosis. Pseudo-dementia due to depression has been described in DS (Markar, Cruz, Yeoh, & Elliott, 2006; J. A. Tsiouris & Patti, 1997), but the reverse is also true – depression may occur in people who have been diagnosed with dementia (Holland, et al., 1998; Strydom, et al., 2007; Tsiouris & Patti, 1997). Coppus et al. (2006) and Burt et al. (2005b) reported that depression was diagnosed more commonly in those with DS and dementia than in those without dementia. Treatment with antidepressant drugs can result in improved quality of life, differentiate pseudodementia from dementia, and improve functioning (Tsiouris & Patti, 1997).

Diagnostic criteria

Given the difficulty demonstrating cognitive deficits in adults with ID and the differences in presentation when compared to the general population, it is important to investigate the performance of diagnostic criteria for dementia in this population. A previous working group recommended the use of ICD-10 criteria (Aylward, et al., 1997) as these put more emphasis on non-cognitive symptoms such as emotional lability and apathy, which are often prominent signs of dementia in adults with ID. ICD-10 dementia criteria have been modified for use in adults with ID (DC-LD criteria) (Cooper, Melville, & Einfeld, 2003).

Several studies have systematically investigated dementia diagnostic criteria in older adults with ID. Clinical judgment, based on ICD10 criteria, resulted in more adults with DS diagnosed with dementia than methods based on test batteries (Burt, et al., 2005a). With regards to each individual ICD-10 criterion in adults with DS, memory decline was the most commonly met criterion, and similar to the general population the criterion for emotional and behavioural change was less often met (Burt, et al., 1998). Holland et al. (1998) found that DSM-IVand ICD10 AD criteria diagnosed the same adults with DS with dementia, but CAMDEX AD criteria were more inclusive. Strydom et al. (2007) compared ICD10, DSM-IVand DC-LD criteria in a sample of older adults with non-DS ID. DSM-IVcriteria diagnosed more participants with dementia than ICD-10 criteria. ICD-10 criteria excluded several cases with moderate to severe dementia. Behavioural and emotional changes, a requirement for diagnosis according to ICD10, were not good at discriminating those with and without dementia.

Care-giving

The course of a dementing disorder affects adults with intellectual disabilities (ID) and dementia, their families, paid caregivers, and the person's friends or co-residents. Care is provided in formal and informal ways and in a variety of settings. The literature include reports by caregivers of the difficulties they experience in providing care, and adults with ID who have commented on their needs in support. However, it appears that little attention has been given to meeting the needs of caregivers.

Service provision and organisational contexts of care-giving

Care-giving has received much less attention than other topic areas. There is a lack of published research on the efficacy of strategies to guide the provision of daily care (Jokinen 2005). In general, the literature focuses on staff care-giving within intellectual disabilities (ID) residential settings. Services are encouraged to pro-actively prepare for dementia care (Janicki & Dalton 2000) and different service models are identified alongside a programmatic approach (Janicki et al. 2002). These include "ageing in place", "in place progression" i.e. moving within the residential complex as needs increases and a "referral out" model. Early diagnosis, clinical support, environmental modification, and program adaptations and specialized care may help to ensure ageing in place, though care demands often result in referrals elsewhere. Chaput (2002) suggests that group home settings may provide conditions associated with better quality of life at lower cost than specialized units. However, the physical characteristics of the homes and adaptations to it are important factors (Janicki et al. 2005). Service planning and care management guidelines exist (Janicki et al. 1995; Watchman 2003; Wilkinson & Janicki 2002) although there is a trend to rely on 'generic' dementia care strategies developed from, and for, circumstances quite different from those common to ID services. Examples of these include large care facilities compared with small group living, and spousal versus parental care.

Finally, in terms of the context of care-giving, the link between organizations with a focus on ID and those focused on Alzheimer's disease is important because one may refer to the other for support or assistance. Janicki and Wilkinson (2007) report that many national level Alzheimer Disease (AD) organizations affiliated to Alzheimer's Disease International (ADI) receive queries about ID and dementia. Based on study findings, the authors made recommendations to improve information and collaboration. These included support for national organizations to frame and initiate efforts that focus on ID-dementia as an issue; liaison between national organizations concerned with dementia and those concerned with ID and Down syndrome; making available education and training on ID-dementia for ADI members, particularly in low income countries; and a report developed in partnership by ADI, IASSID and WHO that encourages public health and dementia care initiatives to include services to people with ID (Janicki et al. 1996).

Caregiver issues

Most studies reported in the literature relate to the experiences and issues of staff in ID services providing care to persons with ID and dementia. There are apparently few differences on subjective and objective measures of burden between staff caregivers in ID service settings and foster family situations (McCallion et al. 2005). As of the literature review date, no published studies have reported specifically on care-giving in the family context. What can be gleaned from the literature is that families appear to have limited involvement and may have little in-put to dementia care as it affects their relative (Janicki et al. 2005; Wilkinson et al. 2004). Furthermore, Watchman (2008) sent a postal questionnaire to 45 members of DS Scotland which indicated that adults with DS are often denied an opportunity to discuss future accommodation and identified a lack of forward planning by caregivers and uncertainty about future accommodation moves.

To understand better the experiences of staff, McCarron & McCallion (2005) propose researching a modified stress and coping framework using two scales, the Care-giving Difficulty Scale – Intellectual Disability (CDS-ID) (McCallion et al. 2005) which is a measure of subjective burden, and the Care-giver Activities Scale – Intellectual Disability (CAS-ID) (McCarron et al. 2002), which measures time spent assisting people with dementia. In early-stage dementia, few people apparently move to alternate living arrangements (Watchman 2008) yet dementia care places increasingly more demands on staff (Janicki et al. 2005). The nature and tasks involved in care-giving change as dementia progresses, most notably from the early to mid-stage for people with moderate ID. Staff time increased with the onset of AD and did so most dramatically for persons with moderate ID. Mid to end-stage dementia and co-morbid conditions are predictors of the need for increased staff time to be spent in care-giving (McCarron et al. 2005).

Increased care-giving time is associated with difficulty experienced by staff and they may experience increased emotional exhaustion (Lloyd et al. 2008). Another important factor is the presence of challenging behaviour, which was found to be negatively correlated with staff well-being in those who cared for people with DS and dementia (Donaldson 2002). Wilkinson et al. (2004) found that few staff in ID services are experienced in dementia care and may react to, rather than plan for, changes in needs. Additionally, to avoid relocation of the person with ID and dementia, staff try to cope with difficulties rather than seek help and, in particular, night staff were essential in maintaining the home environment for the person.

Care-giving and staff training

Finnamore & Lord (2007) suggest that Dementia Care Mapping (DCM), a service intervention strategy introduced in general dementia care, may be useful in planning care for people with ID and dementia. DCM is used to observe and evaluate the quality of life of people living with dementia, and to enhance person-centred care. It consists of three phases where trained “mappers” carry out detailed observations of behaviour and care provision and assign

well-being or ill-being ratings. The observations are analysed, and feedback is given to staff highlighting good and poor practice. In many ID services, planning is apparently poor and care practices are inconsistent (Janicki et al. 2002; Watchman 2008; Wilkinson et al. 2004). In a small study of 8 adults with ID and dementia, DCM highlighted examples of good and bad practice. The process demonstrated positive outcomes after the intervention (Finnamore & Lord, 2007) however, the DCM training and time requirements to achieve this may be beyond the resources of some ID services.

There are staff training issues in the provision of dementia care. For instance, the recognition and treatment of pain is critical yet staff may not recognise pain experienced by persons with ID and dementia. Furthermore, waking at night because of pain may be attributed to a general characteristic of dementia and remain untreated (Kerr et al. 2006). Whitehouse *et al* (2000) investigated the knowledge and attributions of dementia held by care staff and showed that they had a basic level of knowledge of ageing and dementia. When change in behaviour was attributed to dementia, it was most likely to be viewed as stable and uncontrollable, with expressions of pessimism about changing it. Staff training focused on challenging behaviour can positively influence staff knowledge (Kalsy et al. 2007) by changing attributions of the controllability of the behaviour associated with dementia. The timing of training is important so that a service is "dementia-ready" before residents develop problems (Wilkinson et al. 2004).

The literature on end-of-life care also raises a number of issues and suggests the need for staff training involving dying, death and bereavement, communication with palliative care services, and the involvement of individuals and family members in decision-making (McKechnie 2006; Service 2002; Watchman 2005). McCarron (2002) found that 36% of their sample with end-stage AD was on feeding tubes. While noting an absence of specific research, McCarron & McCallion (2007) also offered principles drawn from the general literature to guide decision-making on tube feeding.

Service-user quality of life and the burden of care

Overall, Chaput (2002), as previously mentioned, found small group living may provide better opportunities to maintain or enhance quality of life for the person with ID and dementia as compared to large group settings e.g. nursing homes. Common concepts within a quality of life framework (Schalock et al. 2002) however, may need to be adapted or modified in dementia care and offer potential for the establishment of a proactive approach (McCallion & McCarron 2007). Although dementia is a progressive condition associated with slowly increasing care needs and caregiver burden, the general literature suggests several interventions that may be effective in slowing decline, improving quality of life, and reducing caregiver burden. These include interventions with caregivers or co-residents in the form of education, training, support groups (Acton & Kang, 2001), or pharmacological treatments, exercise and other psycho-social

interventions with the person with dementia (Hogan et al. 2008).

Dementia may also have a negative impact on friends and co-residents of the person. The information provided to them, and their understanding of dementia as it affects their friend or co-resident, varies (Wilkinson et al. 2004). Lynggaard & Alexander (2004) found benefits to conducting short-term, small group sessions with co-residents. Using a variety of visual aids and strategies e.g. role play, the groups offered information in a concrete manner and as a means to discuss the issues and challenges they were dealing with in their home as a result of dementia.

Non-pharmacological interventions for those with dementia

Interventions aimed at family caregivers of adults with dementia in the general population include support groups, education, counselling, respite care, and multi-component interventions. A systematic review of these revealed that only multi-component interventions were associated with a significant reduction of caregiver burden (Acton & Kang 2001). However, positive effects were shown in caregiver psychological distress, caregiver knowledge and patient mood (Brodaty et al. 2003). We have not found any studies of such interventions in caregivers of adults with ID and dementia.

Examples of non-pharmacological interventions with the person with dementia include reminiscence therapy (Woods et al. 2005), cognitive training (Acevedo & Loewenstein 2007), cognitive stimulation (Spector et al. 2008), aromatherapy (Holt et al. 2009), music therapy (Vink et al. 2009), and physical activity programs (Forbes *et al*. 2008). The evidence for the efficacy of music therapy in dementia care is not conclusive. There appear to be benefits to the person with dementia in using aromatherapy (Holt et al. 2009) by reducing agitation and neuropsychiatric symptoms (Ballard et al. 2002).

We found one attempt of a non-pharmacological intervention in adults with ID and dementia using structured psychotherapeutic groups for persons with ID and dementia (Rosewarne 2001). The overall purpose of the weekly group meetings was to promote individual quality of life and maintain the person's level of functioning. Structured activities incorporated activities to promote cognitive functioning and reminiscence. The evidence for non-pharmacological therapeutic strategies for dementia in the ID population, however, is scant. A specific target for intervention might be challenging behaviour, given that this is often an important management problem for caregivers. Millichap et al. (2003) showed that some of the behavioural excesses associated with dementia in adults with DS were functional in nature and therefore potentially changeable.

Pharmacological interventions

Drug therapy is one intervention used in providing care to people with dementia where

caregivers have to supervise its administration. Little is known about the level of knowledge that caregivers in ID services possess on anti-dementia drugs and their side effects.

Treatment with the cholinesterase inhibitors donepezil, rivastigmine and galantamine or the NMDA receptor antagonist memantine are indicated for Alzheimer's disease. The cholinesterase inhibitors are also useful in Lewy body dementia. None of these medications has been demonstrated to be disease modifying, but it has been postulated that maintenance of cholinergic tone in people with early dementia may slow abnormal amyloid deposition in nerve cells. (Lahiri et al. 2004) Although these treatments are targeting brain receptors, other areas of the nervous system are affected. In the UK, NICE (2007) guidance recommends the use of Donepezil, Rivastigmine and Galantamine only for the treatment of moderate Alzheimer's disease in the general population and qualifies it in people with ID. Other health care systems apply their own criteria.

The research evidence on anti-dementia drugs in people with ID is sparse at present consisting of small trials and case reports on side effects. Most of the evidence in this population relates to studies in people with Down syndrome. Interestingly, Johnson et al. (2003) reports on the use of anti-dementia drugs to enhance cognitive function in people with ID who do not have dementia where language function improved but not behaviour.

Lott et al. (2002) conducted a trial of Donepezil in nine people with Down syndrome and mid-stage dementia and demonstrated a rate of decline significantly less among this treated group compared with six who did not receive the drug. Prasher (2003) compared Donepezil with placebo. Active treatment improved behaviour and non-cognitive symptoms even at low doses. Prasher (2005) studied the effect of Rivastigmine in treating dementia in Down syndrome. The rate of decline was less in the Rivastigmine group compared with the untreated group but the study was limited by its small numbers. Pueschel (2006) reported no change in cognitive function using Acetyl-L-Carnitine in forty people with Down syndrome without dementia.

Caregivers need training in awareness of sife effects and their management. Hemingway-Eltormey et al. (1999) reported urinary incontinence, agitation and aggression effects in three people with Down syndrome which ceased on withdrawal. Cipriani et al. (2003) reported abdominal pain and diarrhoea side effects with Donepezil in people with Down syndrome that necessitated its withdrawal. In contrast, Kishnani et al. (2001) and Lott et al. (2002) did not report side effects in people with Down syndrome and dementia.

The use of anti-dementia drugs in people in the general population with dementia is standard practice with a good evidence base. However, corresponding evidence for their use in people with ID is not as strong, relying on small studies and case reports, only among people with Down syndrome. Large studies are required to demonstrate their effectiveness in people with ID.

Conclusions

Over the past ten years there have been many cross-sectional and longitudinal studies on the prevalence, incidence and presentation of dementia in adults with ID. In particular, we have a better understanding of the early symptoms and course of dementia, especially in adults with Down syndrome. It has been established that in adults with DS, signs and behaviours associated with dementia of Alzheimer's type (and other subtypes such as fronto-temporal dementia) emerge during the 5th and 6th decades in approximately one in three of these adults. Age of onset is in the mid 50s, much younger than in the general population. The prevalence increases to the age of 60, but appears to drop after this, possibly due to the increased mortality associated with dementia – mean time to death may be as short as 3 to 4 years after diagnosis. Incidence rates show no decline with ageing. A small but significant proportion of older adults with DS never develop clinical signs of dementia.

Some studies have shown an increased prevalence of dementia in adults with ID who do not have Down syndrome, while others have demonstrated rates similar to that of the general population. This may be partially explained by the fact that some studies included all dementia subtypes, while others focused on AD; the variability of the age range in the groups studied, the cross sectional nature of some studies and representativeness of samples. The severity of ID of the participants may also be a factor, since it is difficult to diagnose dementia in adults who are more disabled. Age of onset (approximately 67 years) was slightly younger than in the general population. Different diagnostic criteria for dementia were also utilized, and the Non-DS groups were not homogeneous for cause of disability.

It is surprising that ageing and cognitive functioning has been studied in so few of the ID syndromes other than DS; for example, we were not able to find any recent dementia studies in even relatively common syndromes such as Fragile X Syndrome. This is a neglected area but potentially very interesting, as it might help to highlight variation in biological ageing and its impact on cognitive functioning due to genetic or other factors.

In the future, larger studies with representative samples using comparable ascertainment and diagnostic methods, and a comprehensive description of participants could clarify these findings. Agreement between researchers on the use of instruments and criteria will help to reduce variation between studies, and enable us to show potentially important temporal, geographical or between-group differences in the epidemiology of dementia. Another area for future studies are to identify biological and/or environmental factors that increase or decrease the risk of age-related functional decline in people with ID, which is an important area of inquiry as it may inform the development of preventative treatments and programs.

We found very few examples of non-pharmacological interventions to improve the quality of life of those with dementia, or to reduce caregiver burden. In terms of pharmacological interventions, Donepezil is the most commonly used anti-dementia drug used in people with

intellectual disabilities to treat dementia, and there is some evidence for the effectiveness of Rivastigmine.

Care-giving occurs on a personal level and is impacted upon by organizational and inter-organizational supports. The key findings of the literature review on dementia care-giving indicate a need for an international research agenda that begins to address gaps in knowledge about the experience and effective strategies used within ID settings. There is a lack of research on the needs of family caregivers. The effectiveness of all potentially useful interventions in people with ID and dementia requires further study, particularly in adults with Down syndrome who have a higher risk and may develop dementia at a relatively young age. It is also critical that knowledge transfer and targeted dissemination of the work to services and caregivers occur.

Future research

Notwithstanding the inconclusive evidence outlined above, it seems reasonable to consider early cognitive decline an important potential concomitant of ageing in people with Intellectual Disabilities. We look forward to research in the next ten years which will provide information that will be useful for clinical and social policy development. We need more representational studies on epidemiology, more clinicopathological correlation studies and more evidence on which to base education and advice for caregivers. Projects to develop and evaluate interventions to manage or prevent decline in older adults with ID are much needed. We need studies of ageing in specific groups, such as those with severe ID or genetic syndromes such as Fragile X syndrome. We would particularly like to recommend international collaborations for such work.

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