

Prevalence and Risk Factors of Choking in Adults with Intellectual Disability: Results from a National Cross-sectional Study

Beatrice Manduchi^{a*1,2}, Margaret Walshe^a, Éilish Burke^b, Rachael Carroll^b, Philip McCallion^c, Mary McCarron^b

^a *Department of Clinical Speech and Language Studies, Trinity College Dublin, Dublin, Ireland;*

^b *School of Nursing and midwifery, Trinity College Dublin, Dublin, Ireland;*

^c *School of Social Work, Temple University, Philadelphia, USA*

*Correspondence details: Beatrice Manduchi, Department of Clinical Speech and Language Studies, Trinity College Dublin, 7-9 South Leinster Street, Dublin 2, Ireland. Email: manduchb@tcd.ie. ORCID ID: 0000-0001-8953-8363

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^{1 2} (Change of affiliation during submission process): ¹*Rehabilitation Sciences Institute, University of Toronto, Toronto, Canada;* ²*Department of Speech Language Pathology, University of Toronto, Toronto, Canada*

Abstract

Background: Choking is a serious and under-recognized condition for adults with Intellectual Disability (ID), with health, psychological and potentially fatal consequences. This study aims to determine the prevalence of choking history and risk factors in a population-based sample of adults with ID.

Method: 597 adults with ID were selected as part of The Intellectual Disability Supplement to The Irish Longitudinal Study on Ageing. Information was collected on choking history, comorbidities, challenging behaviours and eating difficulties. Logistic regression was employed to determine risk factors for choking history.

Results: 17.3% of participants reported a choking history. The co-occurrence of eating difficulties, Cerebral Palsy, visual impairment, being ≥ 65 years old and antipsychotics use increased the odds of choking history.

Conclusions: Choking is prevalent in our sample, especially in individuals with multiple and complex disabilities. Risk assessment should be implemented in usual care. Training staff and caregivers is recommended to increase awareness, prevention and recommendations adherence.

Keywords: choking – asphyxia – swallowing – dysphagia – adult - intellectual disability

MAIN TEXT

Background

Choking occurs when the ingestion or inhalation of food or non-food items causes the obstruction of the respiratory tract (Troche, Brandimore, Godoy, & Hegland, 2014). The inability to breathe may result in insufficient oxygen delivery to the body and may lead to death by asphyxia (National Safety Council, 2015).

Choking is a serious health and safety concern for adults with Intellectual Disability (ID), representing the main external cause of death for adults with ID living in residential care (New South Wales Ombudsman, 2013; 2015). Choking incidents and choking-related deaths in this population are often under-recognised and under-reported (Trollor, Srasuebkul, Xu, & Howlett, 2017). In a US study, Landes, et al. (2019) reviewed 33154 death certificates of adults with developmental disability from 2012 to 2016. They found that choking-related deaths accounted for 4.80% of decedents with ID, 3.76% with Cerebral Palsy (CP); 2.28% and with Down Syndrome. However, these deaths were often coded as “*pneumonitis due to inhalation of food/ vomit*”. Such misinformation is a serious barrier to prevent premature mortality, thus, investigating choking prevalence and related harms in this population is a national priority across numerous developed countries (Hemsley, et al., 2015; Heslop, et al., 2013; Hollins & Tuffrey-Wijne, 2013; Morad, Kandel, & Merrick, 2009; New South Wales Ombudsman, 2015). Furthermore, choking can have a serious impact on the psychological well-being of the person with ID and his/her caregivers (Balandin, Hemsley, Hanley, & Sheppard, 2009; Hemsley, et al., 2019; Westergren, et al., 2002), with support staff involved in choking incidents reporting significant distress and anxiety (Guthrie, Lecko, & Roddam, 2015; Guthrie & Stansfield, 2017).

Adults with ID are at greater risk of choking episodes compared to the general population (Finlayson, et al., 2010; Petropoulou, et al., 2017).

Swallowing difficulties, or dysphagia, represents the primary contributor to choking risk in adults with and without ID (Berzlaovich, et al., 2005; Ekberg & Feinberg, 1992; Samuels &

Chadwick, 2006; Sheppard, et al., 2017; Thacker, et al., 2008). People with ID typically present with oral dysfunctions (e.g. abnormal oral tone, immature chewing, and limited tongue control), poor dentitional status and problems in pharyngeal phase of swallowing (Chadwick & Jolliffe, 2009). All these factors significantly impact on bolus formation and airway protection, with negative consequences for food consumption safety.

Behavioural issues and maladaptive eating behaviours, such as food refusal, cramming food and pica (ingestion of non-food items), may also significantly impact on choking risk (Ball, et al., 2012; Hove, 2007; Matson & Kuhn, 2001). In particular, rapid rate of eating and overstuffing the mouth are common issues in adults with ID who eat independently and have been identified as strong predictors of choking and asphyxiation risk (Samuels & Chadwick, 2006; Sheppard, et al., 2017; Smith, Teo, & Simpson, 2014; Stevenson, et al., 2007).

Support during mealtime is often required to overcome eating and drinking difficulties (Ball, et al., 2012; Mansell, Ashman, Macdonald, & Beadle-Brown, 2002). However, people with ID receiving support for eating might be at increased choking risk if mealtime recommendations are not adhered to (Chadwick, Jolliffe, & Goldbart, 2003).

Mental illness and use of antipsychotic medications are more common among adults with ID than in the general population (Cooper, Smiley, Morrison, Williamson, & Allan, 2007; McCarron, et al., 2010; O'Dwyer, et al., 2017). Choking and choking-related deaths are prevalent in people with mental health disorders (Aldridge & Taylor, 2012; Corcoran & Walsh, 2003), due to a combination of factors, namely dysphagia, challenging behaviours, prolonged institutionalisation and use of tranquillizers, which exacerbate the risk of choking (Chen, Chen, Chan, Lan, & Loh, 2014; Regan, Sowman, & Walsh, 2006). In addition, the use of antipsychotic drugs and their association with dysphagia and choking risk has been widely referred to in the literature (Gallagher & Naidoo, 2009).

Polypharmacy has also been described as a risk factors for choking (Riquelme, et al., 2016; Ruschena, et al., 2003). People with ID are likely to be prescribed a high number of drugs beginning at an early age and continuing into older age (Stortz, et al., 2014).

Other common comorbidities in ID also increase risk of choking, including epilepsy (Chadwick & Jolliffe, 2009), gastroesophageal reflux disease (GERD) (De Veer, Bos, Boer, Böhmer, & Francke, 2008), and dementia (Givens, Prigerson, Jones, & Mitchell, 2011; Shinagawa, et al., 2016).

Specific syndromes in ID may be at increased risk of choking compared to other aetiologies, due to complex interactions between anatomical, functional and behavioural factors (Cooper-Brown, et al., 2008). These include CP (Balandin, et al., 2009), Prader-Willi syndrome (Stevenson, et al., 2007) and Down Syndrome (Smith, et al., 2014; Thacker, et al., 2008).

Previous studies on choking risk in the general population identified age (> 65 years old) as a risk factor for choking (Berzlaovich, et al., 2005; Dolkas, Stanley, Smith, & Vilke, 2007; Ekberg & Feinberg, 1992), due to anatomical and functional changes affecting swallowing (Sheppard, 2006). As people with ID experience earlier onset of conditions associated with ageing compared to populations without ID, a cut-off of 40 years and older is advocated when referencing to older adults with ID (Balandin, et al., 2009; McCarron, et al., 2011; Sheppard, et al., 2017).

Previous studies describing choking and asphyxiation risk among adults with ID have reached conflicting findings and focused on specific subpopulations. Samuels and Chadwick (2006) found that 71.25% of 80 adults with ID and dysphagia was considered at high risk of asphyxiation by their treating Speech and Language Therapists (SLTs), and that 70.7% of people for whom choking data were available (n = 58) had a history of coughing/choking episodes. A cluster of fast rate of eating, cramming food and premature loss of bolus into the pharynx were predictive of high risk for asphyxiation. Similarly, Chadwick and Jolliffe (2009) found that almost 90% of 99 adults with ID and dysphagia were at high risk of asphyxiation, according to their treating SLTs. In a community survey on 674 adults with ID, Thacker, et al. (2008) identified a history of choking in 40% of their sample. This study found the co-occurrence of severe ID, being edentulous, receiving more than two drugs, using tranquillizers, needing help with liquids and Down Syndrome to be predictive factors for choking. Finally, in a study on 619 individuals with severe ID, Sheppard, et al. (2017) identified

15% of participants as having experienced choking episodes. Choking history was predicted by a cluster of nine items, including dysphagia and challenging behaviours at mealtimes.

Rationale and aim

Choking is a serious but under-recognised condition for older adults with ID. Identifying the full range of factors influencing choking risk is crucial to inform and to develop strategies to prevent related morbidity and mortality (Hemsley, et al., 2015).

This study aimed to determine the prevalence of choking history in a population-based sample of adults with ID and to identify the factors influencing their choking risk.

Methods

Study design and participants

This is a retrospective observational study based on data from the third Wave of the Intellectual Disability Supplement to The Irish Longitudinal Study on Ageing, a multi-wave longitudinal study exploring the ageing profile of adults with ID over 40 years old in Ireland. The project commenced in 2009 with a sample of 753 adults randomly selected from the National Intellectual Disability Database of Ireland and deemed to be geographically and demographically representative of the target population (McCarron, et al., 2011). For the third Wave of the study, data were collected on 609 participants between October 2016 and February 2017. Almost all losses to follow-up since the first Wave were due to deaths. This study included 597 adults with ID for whom data on choking history were available.

Ethical considerations

This study complies with the ethical standards and laws applicable in Ireland. Ethical approval was obtained from the Faculty of Health Sciences Research Ethics Committee in *** (de-identified

information for blind review process) and from the 138 service providers involved in the study throughout Ireland.

Data collection

Details on the data collection process are described extensively elsewhere (McCarron, et al., 2011). Briefly, data was collected using a pre-interview questionnaire and a computer-assisted face-to-face interview, conducted by trained researchers. The questionnaire was posted to participants a week in advance of their face-to-face interview and included questions on medical doctor's diagnoses, medication use, and healthcare utilisation. During the face-to-face interviews, data were collected on dietary intake and frequency, activity levels, community participation, mental health and psychological well-being. Data collected in the questionnaire was also confirmed. Participants could complete the interview independently, supported by a key worker/proxy or a proxy could complete the interview on their behalf. The proxy had to have known the participant well and for at least 6 months. All items were designed to be easily understood by people with ID and their proxies.

Measures

Information on prevalence and characteristics of choking episode/s was drawn from responses to four items in the interview-based questionnaire. Participants were asked if they ever experienced choking incidents, their frequency and severity. The latter was determined by asking if the participant ever required an intervention as a result of choking (e.g. Heimlich manoeuvre, hospitalization, attention of nurse, doctor on call). Participants were asked to indicate the item/s that resulted in choking incident/s.

Demographic information comprised data on age, gender, level of ID, ID aetiology and type of residence. Participants' age was merged into three categories: <50 years old; 50-64; ≥65. Additional variables investigated the presence of CP, dementia, epilepsy, emotional, nervous or psychiatric conditions, neurodegenerative disease (Parkinson's disease and/or Multiple sclerosis), stroke and/or Transitional Ischemic Attack (TIA), respiratory conditions, GERD and visual

impairment. The latter was determined by the presence of self-reported visual difficulties. Additional information were collected on: medication use (no polypharmacy <5 drugs; polypharmacy \geq 5 drugs; excessive polypharmacy \geq 10 drugs) (O'Dwyer, et al., 2017) and use of tranquillizers (i.e. antipsychotics, hypnotics/sedatives, anticholinergic, anxiolytics). These data were confirmed from records. Further questions related to participants' dentition status (having own teeth; wearing dentures; being edentulous i.e. nor natural teeth or dentures), challenging behaviours (including self-injury, aggression and/or stereotyped behaviour) and pica. Finally, questions regarding participants' eating and drinking abilities included: eating difficulties (“No”; “Some”; “Much”; “Cannot eat at all”), need for help while eating, type of nutrition (oral, enteral or mixed) and diet (normal or modified).

Statistical analysis

Statistical analysis was completed using Statistical Package for Social Sciences (SPSS) version 24 (IBM Corp. 2016). Descriptive statistics was employed to identify missing values, prevalence of choking history and participants' demographics and comorbidities in relation to choking history. Valid percentages only are presented throughout the paper.

Binary logistic regression was undertaken to determine the predictive value of each variable on choking history. Crude odds ratios (ORs) and Confidence Intervals (CI, set at 95%) were calculated.

A multiple regression model was built to determine the impact of all variables on choking history, while adjusting for confounders. The backwards stepwise method using Likelihood Ratio (LR) was employed. This choice reflected the large number of variables considered and limited information in the literature regarding the most important predictive factors for choking risk in people with ID. All the variables were initially entered in the model and variables not significant to the regression were removed in steps. Multicollinearity between variables was tested by examining the Variance Inflation factor (VIF). A cut-off value of ≥ 2 was considered as correlated (Kutner,

Nachtsheim, & Neter, 2004). Adjusted ORs and 95% CI were calculated. Significance was set at p-value = 0.05.

Results

Sample characteristics and choking history

A total of 597 participants were included in this study. Mean age was 60 years (SD= 8; range: 48-95 years). The majority of participants were female (55.4%) and almost half (46.3%) had moderate ID. Almost all participants (99.5%) were on total oral intake. Of these, 137 participants (23%) were on a modified diet, which, in most of cases, consisted of soft/liquidized food and/or thickened fluids. Challenging behaviours were prevalent within the population sample (n=284, 60%). Pica was reported only by 12 participants; therefore, further analyses including this variable were not carried out due to small sample size.

History of choking was reported by 103 (17.3%) participants. Table 1 summarises sample demographics and characteristics in relation to choking history.

(INSERT TABLE 1 HERE)

Most participants with choking history reported experiencing less than one episode per month (n=87; 84.5%); 11 participants (10.7%) 1 to 2 episode/s per month, and 5 participants (4.9%) reported 3 to 5 episodes per month.

Over three-quarters (n=79; 76.7% participants) never required an intervention for choking, 6 individuals (5.8%) required an intervention for some episodes, and 18 (17.5%) required an intervention every time they choked.

As shown in table 2, 68 participants reported information about the food item/s resulted in choking episodes. “Solid foods” were the most reported item; within those, “*meat*” and “*bread*” were mentioned in 21 and 14 cases, respectively. Some participants identified specific behaviours associated with choking episodes. These included: fast rate of eating (9 people), cramming food (4

people), ingesting large cuts of food (6 people), not chewing it at all (4 people) or a combination of these behaviours.

(INSERT TABLE 3 HERE)

Figure 1 shows the percentage of participants who reported choking history in relation to eating difficulties (figure 1a) and receiving help with eating (figure 1b). Within those with “*Some*” and “*Much*” eating difficulties, 25.7% and 37.5% participants respectively, had a history of choking. Lower percentages of choking history were observed in those with either no or severe difficulty. Participants who did not receive help with eating experienced a choking episode in higher percentages (34.3%) when compared to those who received assistance (22.9%) or were completely dependent for eating (19.2%).

(INSERT FIGURE 1a AND FIGURE 1 b HERE)

Figure 2 shows that for those individuals who reported “*No eating difficulty*” (n = 34), the majority (96%) choked on solid foods. The variable “*Being on a modified diet*” was not further analysed because of too little information on whether the participant experienced the choking episode while already on a modified diet.

(INSERT FIGURE 2 HERE)

Binary logistic regression

Binary logistic regression analysis was conducted to determine the predictive value of each variable on choking history. In table 3, only statistically significant values are reported. Results suggest that living in community group homes and residential care settings increased by 2.7 (95%CI= 1.18-6.29) and 2.9 (95%CI= 1.29-6.78) times, respectively, the odds of choking history compared to living independently. Excessive polypharmacy increased the odds of choking by 2.4 times (95%CI= 1.37-4.33), as compared to being on less than 5 drugs. Being edentulous doubled the odds of choking history (OR= 2.17, 95%CI= 1.30-3.61), as compared to having own teeth. The variables “*Some*” or “*Much*” eating difficulty showed the strongest level of association with choking history, increasing

the odds to choke by 3 (95%CI= 1.82-5.12) and 5.3 times (95%CI= 2.78-10.14) respectively, as compared to those with “*No eating difficulty*”.

INSERT TABLE 3 HERE

Multiple logistic regression

Backwards stepwise logistic regression analysis (LR) was conducted to determine the impact of all variables on choking history. The variables “*Progressive neurodegenerative disease*”, “*Stroke or TIA*” and “*Respiratory conditions*” were removed from the model to prevent the analysis suffering from small sample bias. The variables “*Some eating difficulty*” and “*Much eating difficulty*” were merged into one category to reduce variable outcomes. The item assessing “*Receiving help with eating*” was also removed from the model because only people reporting difficulty eating were asked this question. For all variables the VIF was < 2 , meaning that no variables needed to be excluded for reasons of multicollinearity. After excluding missing cases, a total of 408 participants were included. The final model, containing 5 predictors, was statistically significant ($\chi^2= 51.534$, $df=6$, $p< 0.0001$). The model correctly classified 83.3% of cases and presented significant goodness of fit (Hosmer-Lemshow test: $\chi^2= 6.506$, $df=7$, $p= 0.482$). As shown in table 4, the risk factors for choking that emerged were being ≥ 65 years old, CP, antipsychotics use, visual impairment and some/much eating difficulty.

(INSERT TABLE 4 HERE)

Discussion

This study found a prevalence of 17.3% of choking history among adults with ID over 40 years old, lower than rates reported in previous studies. However, existing prevalence data might be an overestimation, given that only samples at increased choking risk were previously considered, i.e. people with dysphagia (Chadwick & Jolliffe, 2009; Samuels & Chadwick, 2006), or with severe ID level (Sheppard, et al., 2017). Similarly, the findings from a more representative sample, investigated by Thacker, et al. (2008), might have been influenced by self-selection of study participants. To the

authors' knowledge, this is the first population-based investigation exploring choking history in adults with ID. However, the clinical presentation of choking in this population may be extremely variable, and family and staff members often report difficulties in recognising the signs of choking (Guthrie, et al., 2015). Hence, because our data are based on self-report, we acknowledge the possibility of figures being underestimated.

Our analyses revealed that the co-occurrence of a range of disabilities increased the likelihood of reporting choking history. These findings are of critical importance for multidisciplinary involvement in risk identification and management.

In many instances, an intervention was required to respond to choking. Yet, previous studies found that, often, staff members, especially those less trained, are not aware of how to intervene in case of choking (Guthrie, et al., 2015). This data highlights the importance of caregiver and staff training on how to recognise a near-fatal choking episode and how to promptly intervene to avoid asphyxia.

In most cases, choking followed the ingestion of solid food, in particular hard and dry items. This data is in keeping with reports from other populations (Hemsley, et al., 2019). Solid, hard and adhesive food require increased oral preparatory function, which are usually impaired in people with ID (Chadwick & Jolliffe, 2009; Sheppard, 2006). Furthermore, solid food processing requires good dentition, which is typically poor in people with ID (Mac Giolla Phadraig, et al., 2015). In accordance with previous research (Samuels & Chadwick, 2006; Sheppard, et al., 2017), we found “*large cuts*” of solid food to be the cause of numerous choking instances. These findings highlight the importance of maintaining good dentition and/or of the appropriate positioning of dentures to prevent risk of choking on solid food. Other common strategies to reduce risk associated with solid food ingestion include modification of food texture (i.e. to minced, cohesive and moist textures) and of food size (e.g. chopped or diced) (Cichero, et al., 2013). Although the effect of diet modification on eating and swallowing safety has not been demonstrated yet on adults with ID (Manduchi, Fainman, & Walshe, 2019), modification of food texture and size is the most commonly implemented strategy for

managing eating and swallowing difficulties in adults with ID (Ball, et al., 2012). Such measures are also advocated by international policies for reducing choking risk across different populations (Cichero, et al., 2017). More attention to these issues in services for people with ID and in the training of caregivers is critical.

Our study found strong evidence of association between mild to moderate eating difficulty and choking history. This is in keeping with existing research on populations with and without ID (Finlayson, et al., 2010; Samuels & Chadwick, 2006; Sheppard, et al., 2017). Within those reporting most severe eating difficulties, risk of choking was lower. This may mean these individuals already had some strategies in place to prevent choking. However, choking history was also reported in people with no eating difficulty. In many jurisdictions, food safety assessment and management are conducted by the SLT after a referral for eating and/or swallowing difficulties. Given that our findings suggest that not only people referred to SLTs for assessment may be at risk of choking, a choking risk assessment should be conducted on any individual with ID.

The presence of challenging behaviours increased the odds of reporting choking history. Challenging behaviours may interfere with caregivers providing mealtime support, hence exposing the individual to higher choking risk. Furthermore, challenging behaviours have previously been linked to maladaptive eating behaviours, identified as strong predictors of choking in adults with ID (Samuels & Chadwick, 2006; Sheppard, et al., 2017; Smith, et al., 2014; Stevenson, et al., 2007). Although there were no specific questions addressing eating behaviours in our survey, some participants reported specific behaviours that resulted in choking, especially fast rate of eating and cramming food.

In our sample, individuals who ate independently reported a higher prevalence of choking history compared to those receiving mealtime support. People who eat independently are reported to be at higher risk to show maladaptive eating behaviours, thus, increased choking risk (Chadwick, et al., 2003). In addition, people with ID eating independently may have poor awareness of the best conditions required for safe feeding. For instance, Samuels and Chadwick (2006) observed that often

“self-feeders” keep eating even when distracted, fatigued, or not completely alert. Another factor increasing choking risk in “self-feeders” is the lower adherence to eating and swallowing recommendations, as compared to caregivers’ compliance with instructions (Chadwick, et al., 2003). There is a need to better address such education among people with ID themselves and for further education of caregivers.

Our study revealed that 34 individuals receiving help with eating reported choking history. Research suggest that feeding techniques employed by caregivers are not always adequate. In a study on individuals with ID and supporting caregivers during mealtime, Chadwick et al. (2003) found that prompting, pacing and monitoring guidelines were the least adhered to and that rate of feeding was often too fast. They further observed that speed of feeding increased as meal progressed, and that the number of swallows allowed between boluses was inadequate. Furthermore, Samuels & Chadwick (2006) suggest that some carers might not be aware if the person is distracted and keep providing food even if the person is not in the best condition for oral intake, i.e., to eat more.

Living in a community setting or in a residential care facility almost tripled the odds of choking history. This might be explained by the argument that people living in care facilities often present with multiple and severe disabilities that place them at higher risk of choking. Moreover, due to staff and time constraints, people in residential facilities may not be followed and supervised as closely as in a family context. It is suggested that mealtime support is often delegated to less trained staff, who might not be aware of the recommendations for practice (Aziz & Campbell-Taylor, 1999). A further challenge faced in these facilities is that modified diets depend on kitchen staff, who is not always aware of the appropriate food consistency required (Crawford, et al., 2007). All of this said, the data here does not provide the answers needed to understand or address such concerns and additional research is needed looking specifically at the challenges for people with ID in out of home settings.

Training staff and caregivers on diet recommendations and feeding techniques is fundamental to overcoming the challenges faced during mealtime. According to Cichero, et al. (2017),

modification of food texture should be interpreted “*much like a medical prescription*” than a recommendation. Numerous studies have demonstrated the efficacy of direct training to caregivers and support staff in increasing the accuracy of diet modification and adherence to dysphagia recommendations over time (Chadwick, et al., 2003; Chadwick, et al., 2006; Chadwick, et al., 2014; Crawford, et al., 2007; Tredinnick & Cocks, 2013).

Studies have also explored the efficacy of behavioural interventions to reduce maladaptive eating behaviours. In people with autism (Anglesea, Hoch, & Taylor, 2008) and with moderate ID (Echeverria & Miltenberger, 2013), the use of vibrating pagers prompting and pacing the rate of food bites is effective in slowing eating rate, even when the individual is not supervised. More work is needed to explore such interventions while not losing sight of mealtime as a source of enjoyment and not just an occasion for intervention.

In the general population, choking represents as one of the symptoms of GERD and laryngopharyngeal reflux (LPR) (Belafsky, Postma, & Koufman, 2002; Cho, et al., 2015). We hypothesize, but did not test that in our participants, that both LPR and GERD may have contributed to the high prevalence of choking in our sample. In people with ID these conditions are often misdiagnosed as a behavioural disturbance, or undiagnosed entirely (May & Kennedy, 2010), resulting in potential under-recognition of GERD- and LPR-related choking. This is another area where ID-specific research is needed.

People with CP have previously been found to be at increased risk of choking (Calis, et al., 2008; Chadwick & Jolliffe, 2009). Our findings correspond, including that reported incidence of choking and coughing during mealtime increased with age (Balandin, et al., 2009).

In contrast to previous studies (Thacker, et al., 2008), we found no association between choking and Down Syndrome. Albeit prevalent, feeding difficulties in this population are variable (Field, Garland, & Williams, 2003), thus, it might be difficult to draw a pattern of choking risk factors in this population. Moreover, due to dental abnormalities and oral hypotonicity, people with ID usually follow a modified diet, which may be protective against choking (Hemsley, et al., 2019).

Excessive polypharmacy increased choking risk by 2.44 times in our sample. Side effects of polypharmacy, such as decreased alertness, xerostomia and low arousal on swallowing functions are well known (Gallagher & Naidoo, 2009), and it is suggested that adults with ID are more vulnerable to side effects of medications, adverse drug reactions and interactions (O'Dwyer, McCallion, McCarron, & Henman, 2018). We also found a very strong evidence of association between antipsychotics and choking risk, in keeping with studies on psychiatric populations (Regan, et al., 2006; Ruschena, et al., 2003). Our study found a moderate evidence of association between choking and anticholinergic drugs, which may impact on swallowing by leading to impaired oesophageal motility and dry mouth. Previous studies on choking risk in people with psychiatric disorders suggested, in the choice of sedative and/or antipsychotic drugs, to prefer compounds with minimal anticholinergic activity (Fioritti, et al., 1997). Overall, these findings highlight the importance of monitoring medications, their side-effects and timing of administration to manage choking risk, especially in the light of the high incidence of potentially inappropriate prescribing in adults with ID (Gomes, et al., 2019; O'Dwyer, et al., 2018).

This is the first time in the literature, to the best of our knowledge, that visual impairment has been explored and identified as a risk factor for choking. Poor eyesight may mean difficulties in food selection and/or in appropriate bite size judgement. Although individuals with ID and visual often require mealtime assistance, the assistance provided to these individuals could vary from total support to intermittent observation (Ball, et al., 2012). Further research is advocated on adherence to mealtime recommendations in individuals with poor eyesight.

Implications

The confirmation of a high prevalence of choking risk in adults with ID suggests that choking risk assessment should be implemented in usual care for each individual, especially those with multiple and complex disabilities. That numerous predictors of dysphagia (e.g. level of ID, Down

Syndrome, psychiatric conditions) were not predictive of choking in our sample, suggests that choking may also occur in the absence of swallowing difficulties.

An interdisciplinary involvement in the assessment and management of choking risk has the potential to better recognize, address and prevent harms related to choking episodes. Particular attention is needed to the presence of challenging behaviours and how these interfere with mealtimes, recognition and management GERD and LPR, oral health and dental status, medications interactions and timing of administration, and visual impairments.

This study has important implications for SLT assessment. Given the synergy of factors impacting on choking risk, a formal instrumental assessment of swallowing might not be sufficient to evaluate the ability of the individual to manage food safely. Evaluation should instead include a detailed client history, medications review and mealtime observation in an ecological environment (Riquelme, et al., 2016).

Strategies to manage choking risk among this population should be paired with regular reporting of choking episodes, including details on the circumstances surrounding the incident (e.g. environment, time of the day, type of food and behaviour, etc.). Regular reporting might help better defining the actual prevalence of such condition and related factors and increasing the awareness of choking among caregivers and staff (Finlayson, et al., 2010; Guthrie, et al., 2015; Heslop, et al., 2013).

Training staff and caregivers has the potential to increase confidence in providing mealtime support and adherence to mealtime recommendation (Ball, et al., 2012; Guthrie, et al., 2015; Leslie & Drinnan, 2007). It is equally important to raise the awareness among individuals with ID, especially among those who eat independently. Accessible information should be given on how to prevent choking risk, and on hazard foods in ways that continue to value independence and the enjoyment of meals.

Strengths and limitations

The major strength of this study is the size and representativeness of the sample, randomly selected from a national database. Another important strength is the broad range of information collected for each individual, that allowed the detection of risk factors never identified in previous studies. However, due to our research design, relationships of causality cannot be determined. That information was based on self-report also raises concerns. For instance, participants may have confused choking episodes with coughing instances, or have not recognised choking if their presentation was subtle. In addition, self-reported eating difficulties cannot be interpreted as swallowing difficulties. Finally, a relationship between choking history and modified diet could not be assessed because most participants did not specify whether the choking episodes occurred when the modified diet was in place or not. However, given data that eating solid food was most reported as resulting in choking, modifying diet according to the individual's swallowing abilities may be critical to prevent risk of choking (Hemsley, et al., 2015).

Conclusion

Choking risk in adults with ID is prevalent, especially for individuals with multiple and complex disabilities. Managing choking risk is challenging and requires collaborative interventions by the multidisciplinary team to prevent choking incidents in this population. The role of caregivers and support staff is critical in the management of risk factors, and training is recommended to increase awareness, knowledge, reporting, prevention and intervention, as well as adherence to mealtime recommendations.

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Table 1. Sample characteristics in relation to choking history.

Variable	History of choking episode						
	Total		Yes		No		
Age (n=597)	<50	69	11.6%	9	8.7%	60	12.1%
	50-64	376	63.0%	57	55.3%	319	64.6%
	≥65	152	25.5%	37	35.9%	115	23.3%
Gender (n=597)	Male	266	44.6%	47	45.6%	219	44.3%
	Female	331	55.4%	56	54.4%	275	55.7%
Level of ID (n=549)	Mild	133	24.2%	22	22.4%	111	24.6%
	Moderate	254	46.3%	44	44.9%	210	46.6%
	Severe/ Profound	162	29.5%	32	32.7%	130	28.8%
Type of residence (n=597)	Independent/ Family	92	15.4%	7	6.8%	85	17.2%
	Community group home	240	40.2%	44	42.7%	196	39.7%
	Residential Care	265	44.4%	52	50.5%	213	43.1%
Down Syndrome (n=597)		107	17.9%	20	19.4%	87	17.6%
Cerebral Palsy (n=596)		45	7.6%	14	13.6%	31	6.3%
Dementia (n=596)		51	8.6%	9	8.7%	42	8.5%
Epilepsy (n=596)		212	35.5%	40	38.8%	172	34.9%
Psychiatric condition (n=596)		312	52.3%	60	58.3%	252	51.1%
Neurodegenerative disease (n=596)		9	1.5%	3	2.9%	6	1.2%
Stroke or TIA (n=596)		32	5.4%	5	4.9%	27	5.5%
Respiratory conditions (n=596)		23	3.9%	5	4.9%	18	3.7%
GERD (n=596)		97	16.3%	29	28.2%	68	13.8%
Polypharmacy (n=543)	No polypharmacy	200	36.8%	24	25.3%	176	39.3%
	Polypharmacy	203	37.4%	36	37.9%	167	37.3%
	Excessive polypharmacy	140	25.8%	35	36.8%	105	23.4%
Antipsychotics (n=544)		247	45.4%	59	62.1%	188	41.9%
Hypnotics/sedatives (n=544)		95	17.5%	19	20.0%	76	16.9%
Anticholinergic (n=544)		70	12.9%	19	20.0%	51	11.4%
Anxiolytics (n=544)		99	18.2%	20	21.2%	79	17.6%
Visual impairment (n=586)		130	22.2%	30	30.0%	100	20.6%
Dentition status (n=594)	Having own teeth	372	62.6%	52	51.0%	320	65.0%
	Wearing dentures	107	18.0%	20	19.6%	87	17.7%
	Edentulous	115	19.4%	30	29.4%	85	17.3%
Challenging behaviours (n=473)		284	60.0%	58	72.5%	226	57.5%
Eating difficulties (n=594)	None	335	56.4%	34	33.0%	301	61.3%
	Some	144	24.2%	37	35.9%	107	21.8%
	Much	56	9.4%	21	20.4%	35	7.1%
	Cannot do at all	59	9.9%	11	10.7%	48	9.8%
Help with eating (n=259)	No	102	39.4%	35	50.7%	67	35.3%
	Yes	105	40.5%	24	34.8%	81	42.6%
	Complete support	52	20.1%	10	14.5%	42	22.1%
Modified diet (n=595)		137	23.0%	44	42.7%	93	18.9%

Table 2. Food items resulted in choking episode.

Item	f	%
Any food	9	13.2%
Solid food	50	73.5%
Fluids	1	1.5%
Double consistency	3	4.4%
Medication	2	2.9%
Saliva	1	1.5%
Non-food items	2	2.9%
Total	68	100%

Table 3. Binary logistic regression for choking history.

Variable		p-value	Crude OR	CI (±)
Type of residence	Independent/ Family	0.035	-	-
	Community group home	0.019	2.726	(1.180; 6.297)
	Residential Care	0.010	2.964	(1.295; 6.786)
Cerebral Palsy		0.013	2.344	(1.199; 4.584)
GERD		<0.0001	2.449	(1.486; 4.038)
Polypharmacy	No polypharmacy	0.009	-	-
	Polypharmacy	0.108	1.581	(0.905; 2.763)
	Excessive polypharmacy	0.002	2.444	(1.378; 4.335)
Antipsychotic		<0.0001	2.275	(1.444; 3.586)
Anticholinergic		0.024	1.951	(1.091; 3.488)
Visual impairment		0.040	1.654	(1.023; 2.676)
Dentition status	Having own teeth	0.011	-	-
	Wearing dentures	0.231	1.415	(0.802; 2.495)
	Edentulous	0.003	2.172	(1.305; 3.613)
Challenging behaviours		0.014	1.948	(1.147; 3.310)
Eating difficulties	None	<0.0001	-	-
	Some	<0.0001	3.061	(1.829; 5.125)
	Much	<0.0001	5.312	(2.782; 10.143)
	Cannot do at all	0.063	2.029	(0.963; 4.273)
Help with eating	Yes/ Complete support	-	-	-
	No	0.025	1.89	(1.082; 3.302)

Table 4. Multiple logistic regression model for choking history.

Variable		<i>p</i> -value	Adjusted OR	CI (±)
Age	<50	0.001	-	-
	50-64	0.273	1.873	(0.61; 5.751)
	≥65	0.007	4.875	(1.546; 15.373)
Cerebral Palsy		0.008	3.164	(1.359; 7.364)
Antipsychotics		0.001	2.822	(1.564; 5.091)
Visual impairment		0.032	2.061	(1.064; 3.994)
Eating difficulties	None	0.002	-	-
	Some/ Much difficulty	0.001	2.662	(1.477; 4.799)
	Cannot do at all	0.887	0.925	(0.313; 2.729)

Figure 1. History of choking according to (a) Eating difficulty and (b) Receiving help with eating

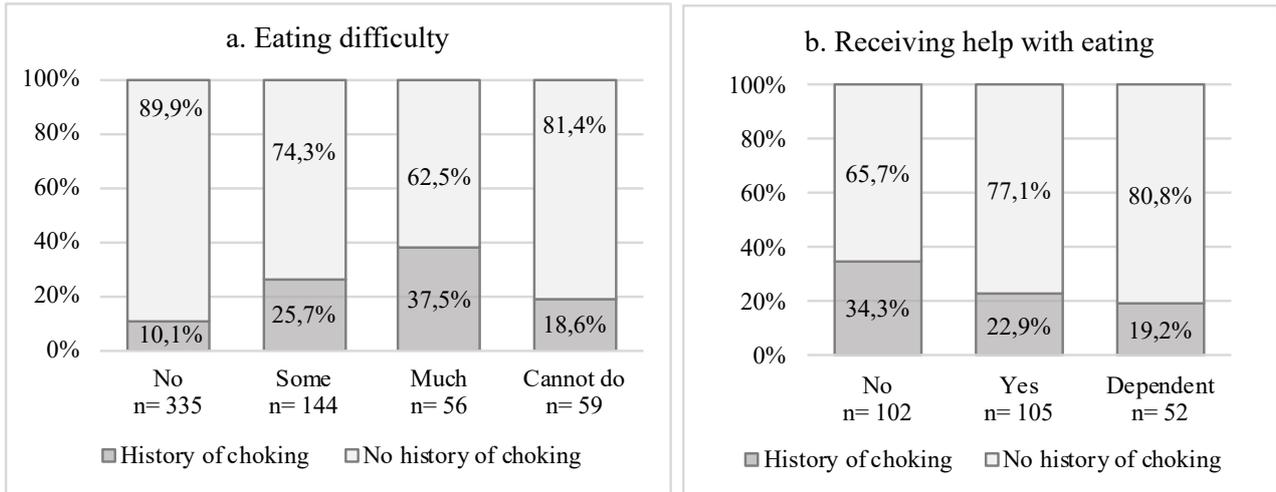


Figure 2. Food items resulted in choking episodes according to eating difficulty.

