

Child Safety Policy in High-Rise Building as Preventive Measures of Child Falls—A Review

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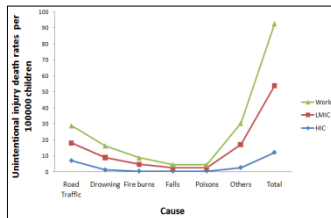
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Graphical abstract



Abstract

Urbanization is one of the factors that lead to the high-rise buildings construction and vertical commercial development in developed countries especially in high density area to ensure that housing stock is sufficient. The continuous growth of high-rise residential properties indicates that there is a need for an effective property management system to provide a sustainable high-rise residential property development. The children who live in high-rise residential would be exposed to danger or accident especially risk of fall from height and currently has been occurring nation-wide for many years resulting serious injuries and deaths. This incident can be avoided by incorporating simple child safety designs into new homes or by providing child safety features into existing homes. However, this matter requires the intervention of policy and legislation for the enforcement of the implementation. Hence, this paper attempt to reviews the literature concerning the needs of policy related to child safety for high-rise residential in order to control an accident involving children falls. The outcome of this study hopefully will ensure the implementation of child safety policy in order to prevent child falls and make sure the building is safe to be occupied especially for children.

Keywords: Child; safety; high-rise building; residential; child falls; safety policy

Abstrak

Urbanisasi adalah salah satu faktor yang membawa kepada pembinaan bangunan tinggi dan pembangunan komersial secara menegak di negara-negara maju terutama di kawasan kepadatan tinggi bagi memastikan stok perumahan mencukupi. Pertumbuhan harta tanah kediaman bertingkat tinggi yang berterusan menunjukkan bahawa terdapat keperluan untuk sistem pengurusan hartanah yang berkesan untuk menyediakan bangunan harta tanah kediaman bertingkat tinggi lestari. Kanak-kanak yang tinggal di bangunan kediaman bertingkat tinggi akan terdedah kepada bahaya atau kemalangan terutama risiko jatuh dari tempat tinggi dan pada masa kini telah berlaku di seluruh negara sejak bertahun-tahun mengakibatkan kecederaan serius dan kematian. Kejadian ini boleh dielakkan dengan menggabungkan reka bentuk keselamatan kanak-kanak yang ringkas bagi rumah baru atau dengan menyediakan ciri-ciri keselamatan kanak-kanak bagi perumahan sedia ada. Walau bagaimanapun, perkara ini memerlukan campur tangan dasar dan perundangan bagi penguatkuasaan pelaksanaan. Oleh itu, kertas kerja ini merupakan kajian literatur berkenaan keperluan dasar yang berkaitan dengan keselamatan kanak-kanak bagi bangunan kediaman bertingkat tinggi untuk mengawal kemalangan yang melibatkan kanak-kanak jatuh. Hasil kajian ini diharapkan akan memastikan pelaksanaan dasar keselamatan kanak-kanak untuk mengelakkan kanak-kanak jatuh dan memastikan bangunan bertingkat tinggi selamat untuk diduduki terutamanya bagi golongan kanak-kanak.

Kata kunci: Kanak-kanak; keselamatan; bangunan tinggi; kediaman; kanak-kanak jatuh; polisi keselamatan

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1.0 INTRODUCTION

Urbanization is one of the factors that lead to the construction of high-rise buildings and vertical commercial development in developed countries especially in high density area. In Malaysia, living in high-rise residential is not an option. The limited of land supply in Malaysia has led to the development of high-rise

building especially for residential purposes. The demand on the high-rise residential building always increased every year. This situation happens because the land area for the usage has become rapidly decreased every single day. These conditions occur because there are construction and housing development which requires more land area and space [1]. The increase in demand for housing and the scarcity of land for development of landed

residential properties in major urban areas in Malaysia such as Penang, Kuala Lumpur, Selangor and Johor Bahru, has resulted in the rapid development of high-rise residential schemes in these high-density areas [2]. Currently, living in a high-rise residential building is becoming as a new lifestyle or trend among the urban professional community. The continuous growth of high-rise residential properties indicates that there is a need for an effective property management system to provide a sustainable high-rise residential property development [1]. Unfortunately, most of the existing high-rise residential building were not effectively managed and lack of awareness about the sustainable agenda in housing management. This matter will lead to certain people feel unsafe to occupy the high-rise residential.

High-rise residential is not only occupied only by adults, but also include children. The children who live in high-rise residential would be exposed to danger or accident especially risk of fall from high [3]. The incidences of people including children falling from residential buildings are not a recent phenomenon but have been occurring nation-wide for many years resulting serious injuries and deaths. The number of incidents involving children at a national level and the severity of injury is however not fully clear [4]. In 2004, approximately 950 000 children under the age of 18 years died of an injury. The majority of these child injuries were the result of road traffic collisions, drowning, burns (fire or scalds), falls or poisoning [5].

Accidents involving children should be avoided by establishing the preventive measures. However, the incident involving child fall can be avoided by incorporating simple child safety designs into new homes or by providing child safety features into existing homes. Child home safety is an important component of home design but has largely been neglected. Hence, this paper attempt to reviews the literature concerning the needs of policy related to child safety for high-rise residential in order to control an accident involving children falls in high-rise building. The outcome of this study hopefully will assist to ensure that the implementation of child safety policy will help to prevent child falls and make sure the building is safe to be occupied especially for children. It is expected that the input from the discussion will give a new dynamic perspective on the implementation of child safety policy for high-rise building especially among high-rise residential in Malaysia.

2.0 THE CONCEPT OF CHILD SAFETY

Child injuries are a growing global public health problem. There are a significant area of concern from the age of one year, and progressively contribute more to overall rates of death until children reach adulthood. Hundreds of thousands of children die each year from injuries or violence, and millions of others suffer the consequences of non-fatal injuries [5].

Child is a young human being below the age of puberty or below the legal age of majority. There is no universally agreed age range for what constitutes childhood. National Child Policy (2009) state that children are a part of a very important community which becomes the assets of the country and lead the national development in the future. In 2008, there were 10.5 million (37.9%) children of the 27.7 million population of Malaysia. Therefore, the Government is concerned about the well-being and interests of the child.

Children Act (2001) defines a child as a person under the age of 18. Protection of children refers to the strategies and activities to prevent and respond to neglect, abuse, violence and exploitation of children. Neglect refers to the continuous and serious failure to provide basic physical, emotional and

development in terms of health, education, emotional development, nutrition, shelter and secure living for children.

Table 1 Unintentional injury death rates per 100000 children by cause and country income level, world 2004 [5]

	Road Traffic	Drowning	Fire burns	Falls	Poisons	Others	Total
HIC	7.0	1.2	0.4	0.4	0.5	2.6	12.2
LMI	11.1	7.8	4.3	2.1	2.0	14.4	41.7
World	10.7	7.2	3.9	1.9	1.8	13.3	38.8

HIC = High-income countries; LMIC = low-income and middle-income countries.

Children are constantly exposed to hazards in their daily lives. Table 1 shows the statistics of accidents involving children all over the world in 2014. Neglect can expose children to all kinds of hazards, including the threatening of their life. In 2004, approximately 950 000 children under the age of 18 years died of an injury. The majority of these child injuries were the result of road traffic collisions, drowning, burns, falls or poisoning. Table 1 above shows the world statistic of unintentional injury death rates by cause and country income level in 2004. The rate of child injury death is 3.4 times higher in low income and middle-income countries than in high-income countries, but there are large variations according to the category of injury death. For fire and flame deaths, the rate in low-income countries is close to 11 times higher than in high-income countries, for drowning it is six times higher, for poisons four times and for falls around six times higher.

However, this paper attempt to concern about child injury by fall in high-rise building. Even though the fall was not a major factor of child mortality, but nearly 47 000 children and youth under the age of 20 years died as a result of a fall [5]. Falls are one of the leading causes of unintentional injuries in the United States, accounting for approximately 8.9 million visits to the emergency department annually. This large number of fall indicates that this accidents need to be prevented especially in high-rise building.

3.0 WHAT IS HIGH-RISE BUILDING?

A building is an enclosed structure that has walls, floors, a roof, and usually windows. A 'tall building' is a multi-story structure in which most occupants depend on elevators [lifts] to reach their destinations. The most prominent tall buildings are called 'high-rise buildings' in most countries and 'tower blocks' in Britain and some European countries [11].

The National Fire Protection Association defined a high-rise building as a building taller than 75ft (23 meters) in height measured from the lowest level of fire department vehicle access to the floor of the highest occupiable storey [12]. Another opinion says a high-rise structure is one that extends higher than the maximum reach of available fire-fighting equipment and it is between 75ft and 100ft. A particular building is deemed a high-rise specified by the fire and building codes in the area in which the building is located [13].

A building is defined by the Uniform Building Codes as a high-rise building when it has floor for human occupancy which are more than 75ft above the lower level of fire department access. Second definition as stated in Uniform Building Codes is the buildings meet the definition to be equipped with an automatic fire sprinkler system designed in accordance with requirements in

Uniform Building Codes [14]. In the study of sample survival after a free fall with impaction on concrete is highly unlikely if the distance fallen is more than five storeys [17]. Therefore, those buildings taller than 75ft or roughly building taller than five (5) storeys in height are categorized as a high-rise building.

■4.0 AWARENESS OF CHILD SAFETY FOR HIGH-RISE BUILDINGS

Many countries, especially developed countries have realized the importance of child safety in high-rise buildings. This can be

proved by researches that have been done. During the period January, 1965-September, 1969, there were 201 deaths due to falls from high places among children under 15 years of age in New York City. Alteration of the environment is seen as the most likely means for effective prevention [16]. The research on child safety for high-rise building already conducted since 1969 shows that awareness of the safety in protecting child falls has been realized long time ago.

Table 2 Discussion on child falls from high-rise building

Author(s)	Methodology and Approach	Key Findings
Lawrence Bergner, Shirley Mayer and David Harris (1969)	Using data from the four hospitals in the Bronx during the period from June 9 to August 15, 1969. Interviews were obtained with 9 families of nonfatal cases and 6 families in which deaths resulted.	The victim of the accident was to climb to the site of the fall (be it a window, fire escape, or the like). In most of these falls the child had been "playing," either in the window or on the fire escape, and fell.
Daniele Risser, Anneliese Bronsch, Barbara Schneider, Georg Bauer (1996)	Using records of victims of a fall from height treated in 1989 at Viennese emergency units included post-mortem reports of deaths due to falls from height, examined in the same year at the Institute of Forensic Medicine in Vienna.	Death usually resulted when the distance was more than five storeys. In relation to the outcome after a fall from the first floor, the risk of dying increased 6.4 times after a fall from the third storey, 10 times after a fall from the fourth storey and 28 times after a fall from the fifth storey.
Sean M. Buckley, David J. Chalmers, John D. Langley (1996)	Source of mortality and hospitalization data from the New Zealand Health Information Service's (NZHIS) injury mortality data files for the period 1 January 1977 to 31 December 1986 inclusive and Coroner's investigative reports held at the Department of Justice in Wellington.	Three hundred and eighty-five falls were from buildings (55.1%). 41.6% were from a roof, 28.3% were from a balcony, patio, verandah, etc., and 16.6% were from a window. Among those who fell from a balcony or window, 43.1% and 42.2%, respectively, were 0-4 years of age.
M. Lallier, S. Bouchard, D. St-Vil, J. DuPont, and M. Tucci (1999)	Reviewed all admissions after a fall at a single institution from 1994 to 1997. Inclusion criteria are falls from a minimum height of 10 feet.	Falls from height carry a significant morbidity and are costly to the health care system.
Mohamad Tajuddin Mohamad Rasdi (2007)	Review the callousness and ignorance of architects, planners, developers and the housing authorities about this issue of child's safety in housing.	Corridors, balconies and windows should be provided with an extended floor slab or a trellised overhang with acts as a sun shading device, protection against rain or even the incorporation of planter boxes. Create a multi floor building with different floor plants at each level (if child does fall, they would land on another floor)
Brenda J. Shields MS, Elizabeth Burkett, Gary A. Smith MD (2009)	Retrospective analysis of data from the National Electronic Injury Surveillance System of the US Consumer Product Safety Commission was conducted to describe the epidemiology of balcony fall-related injuries.	Fall heights ranged from 5 to 87.5 ft. Structural failure of the balcony was involved in an estimated 5600 cases. Patients younger than 18 years were more likely to sustain a concussion/closed head injury or skull fracture than adults.
Suleyman Goren, Mehmet Subasi, Yasar Tyrasci, Fuat Gurkan (2003)	Data collected retrospectively from the files of the Branch of the Council of Forensic Medicine in Diyarbakir between 1996 and 2001. All case files were reviewed including the autopsy, investigator's report, police reports, medical records, suicide notes and scene photographs/diagrams.	Falls from heights were most common in the 0–5 year age group, females had a higher suicide rate than males, and the majority of accidental falls occurred at home rather than in the workplace.
Penelope Carroll, Karen Witten & Robin Kearns (2011)	Interview-based study undertaken with parents living with children in apartments in medium and high density settings in Auckland's CBD	The findings presented under five thematic headings: benefits of apartment living; drawbacks of apartment living; apartment and neighbourhood amenities; social connections; and longer-term housing aspirations.

Table 2 shows a summary of previous researches discussed in respect of the child safety in high-rise buildings. Most of the researches discussed about the causes of children falls, distance fallen and the way to prevent child falls. This shows that most countries have been aware about the risks of living in high-rise buildings for children and require preventive measures before it become worse.

■5.0 THE IMPLEMENTATION SAFETY POLICY AND LEGISLATION IN HIGH-RISE BUILDING

Children are important to the country's human capital. In that regard, the human capital can be developed to an optimum level by providing a safe and conducive environment. Hence, the protection of children from neglect, abuse, violence and exploitation is an important aspect and should be given priority. In Malaysia, a legislation that protecting children named Child Act 2001 (Act 611). Under section 17 1(a) of this act mention that a

child is in need of care and protection if the child has been or there is substantial risk that the child will be physically injured or emotionally injured or sexually abused by his parent or guardian or a member of his extended family.

But, in the development of high-rise residential in Malaysia, there are numbers of policies and legislation directly and indirectly concerned about the safety of high-rise housing development. The legislation and policies includes National Housing Policy (DRN), National Urbanisation Policy (NUP), The Tenth Malaysia Plan (10MP), The National Physical Plan (NPP), The Town and Country Planning and etc. However, most of the policies, laws and regulations will only discussed about the safety aspect in terms of external factors such as crime and external threats without emphasis on the internal threat of the building itself. The current guidelines only emphasize building design for Disabled (OKU) and the design of an emergency incident such as fire. However, there is lack in comprehensive security action in

term of occupancy especially for the children as they are also occupy the high-rise residential and exposed to the risk of falling from a high building.

In the others countries such as Australia, Canada, United Kingdom, Singapore, New Zealand and etc, policy for protecting children fall from high-rise building has been implemented. From 2013, the Building Code of Australia (BCA) has been altered to require all new windows to be fitted with safety devices to protect children from falling. This will render all new building stock safe. However, most children who live in strata schemes live in older stock that will not be affected by the BCA. The Strata Schemes Management Act 1996 (SSMA) must be changed to retrofit existing buildings in which most children live [3]. Overseas experience demonstrates that mandatory provisions result in significant decreases in child fatalities. Most of the countries are concerned about the height of balustrades barrier and the openable windows.

Table 3 International Building Standards: Windows and Balustrades [4]

Country	Balustrades barrier	Openable Windows
Australia	Balustrades 89mm	Sills less than 1200mm above the floor.
United Kingdom	Balustrades on external balconies: 1100mm. Where buildings are likely to be used by children under 5 years openings in barriers must not exceed 100mm.	Minimum sill height: 800mm. No provisions to require windows to have guards or restricted openings.
New Zealand	Balustrades on balconies/decks (single dwelling houses): 1000mm. Other buildings: 1100mm. In housing and other areas likely to be frequented by children under 6 years openings must not exceed 100mm.	In housing and other areas likely to be frequented by children under 6 years of age a window with an opening width of less than 1000mm shall have either: <ol style="list-style-type: none"> the lower edge of the opening at least 760mm above the floor level; or a restrictor fitted to limit the maximum opening so that a 100mm diameter sphere cannot pass through it, or a 760mm high barrier protecting the opening of solid construction or with vertical members throughout its full height.
Singapore	Balustrades (generally): 1000mm. Openings in barriers must not exceed 100mm.	Minimum sill height: 900mm. No provisions to require windows to have guards or restricted openings.
Canada	<ul style="list-style-type: none"> Exterior landings (general): 1070mm. Exterior balconies (single family dwelling units): 900mm. Exterior stairs and landings more than 5 meters above a surface below: 1500mm. Openings (where children may be present): 100mm. 	Minimum sill height (or guard): 1070mm above floor level or mechanisms capable of limiting a window opening to no more than 100mm where the bottom section of openable portion of a window is higher than 1800mm above an external surface below. <p>*Changes to the National Canadian Building Code relating to window designs and the risks posed to children falling through openings came into effect in November 2010. The changes apply to new construction only and do not require the retrofitting of window safety devices in existing residential buildings.</p>

Table 3 shows the countries that have implemented the international building standards to protect children from accidents in high-rise buildings. Majority of the country above have specify a maximum opening dimension of 100mm to make sure it is safe for children.

6.0 CHILD SAFETY POLICY IN HIGH-RISE BUILDING AS PREVENTIVE MEASURES OF CHILD FALLS

The landmark Convention on the Rights of the Child, ratified by almost all governments, states that children around the world have a right to a safe environment and to protection from injury and violence [5].

Living in high-rise residential is not a choice of child. It is a choice of an adult. A home may represent a haven of safety and security but for young children, it can also be a minefield of potentially dangerous falls. Most people think of their home as a fortress that will keep their children safe. Unfortunately, there are many emergencies that are beyond control. Just because a child is at home does not necessarily mean they are safe. That is the

reason why it is important to plan a safety requirement starting at home to keep children safe.

The accident occurred in high-rise residential building involving people especially children falling from residential buildings are not a recent phenomenon but have been occurring nation-wide for many years resulting serious injuries and deaths [4]. Child home safety is an important component of home design but largely neglected. In Malaysia, this incident could have been avoided and should not happen especially to the child. Lately, incidence of children falling from flats, condominiums or multi-storey residential has been featured in many media. The accident not only caused serious injuries, but mostly fatal to children involved [5].

Dangers that are obvious to adults are not necessarily that apparent to children. They need extra guidance and an ever-vigilant eye. Because of that, parental negligence often blamed for failing to supervise or pay attention to cause an accident involving children. However, parents or other adults are not to be blamed entirely if such unfortunate incidents happen. According to Director of Pusat Kajian Alam Bina Dunia Melayu (KALAM), Faculty of Built Environment, Universiti Teknologi Malaysia

(UTM), Assoc. Mohamad Tajuddin Mohamad Rasdi, vigorous activity was normal for children. He stated that it is natural instinct of children who are always active or desire to learn and do something that may be harmful to themselves [8]. Therefore, before high-rise residential construction, architects and developers should consider the appropriateness of the venue as a place of residence occupied by families that have small children. Unfortunately most of the homes built in the low-cost flats seem not to meet standards of living quarters, as the house was built the same as the office design. In some other countries such as Australia, Singapore, United Kingdom, Canada and New York, they have been recognized the policy to protect the children from accident during at home.

Housing is the basic needs for all and due to rapid growth in population and income has lead to the increase in housing demand. The concept of high-rise or strata living in this country were applied for many years. However, the management of high-rise residential system practiced in this country still primitive and not systematic. The current trend is more towards a better and quality of living. They do not merely want to buy just a house but a home with complete housing amenities [2]. Safety is the most important requirement to fulfill the housing needs to be free from the threat of harm to the body and soul as well as to ensure the physical and emotional health.

Incidents of children falling often related to windows and balconies. When the weather is pleasant outside many people open their windows to let the breeze in. While the fresh air feels good, open windows can pose a serious danger to young children. However, this incident can be avoided by incorporating simple child safety designs into new homes or by providing child safety features into the existing homes [7]. This matter can be enforced through the formulation and implementation of policies and legislation to protect children in high-rise building.

■7.0 DISCUSSION

In this section, author will discuss on how the implementation of legislation and policy will reduce the problem of accidents in high-rise building. By offering the effective policy of child fall prevention in high-rise building, we can reduce fall and help children live better, longer lives. While successful litigation against management corporation for failing to provide locks or limiting devices on windows would no doubt motivate most strata schemes to address their own risk, this is a less than ideal solution. A preferable option would be the minor alteration to the Strata Act on children's fall.

This study could contribute to the implementation of policies and legislation in order to ensure the safety of the children on high-rise residential from a global perspective; the contribution is equally accepted by other countries that have been implemented policies and legislation to protect the safety of children on high-rise housing. The finding from this study can be use to highlight the contribution of child safety policy to high-rise residential. Thus, it can encourage safety of the people living in high-rise residential in order to achieve sustainable housing development.

This study will improve the housing quality especially in safety aspect. Legislative amendments aimed at strata and high-rise residential would provide protection to a significant proportion of children likely to be at high risk of a fall of this type. Overseas experience demonstrates that mandatory provisions result in significant decreases in child fatalities.

It will also provide safe environment as well as to bring peace of mind for parents when child home safety features are incorporated into the home. This means that if a parent turns their attention away from the child for only a few moments, they can be

confident that their child will not be able to do something harmful.

■8.0 CONCLUSION

From the review, high-rise strata schemes present real and significant risks to children's lives, as demonstrated by the number of children who have fallen from windows or balconies. It can be conclude that the phenomenon of child accident in high-rise residential building can be avoid by implementing the policy and legislation for incorporating simple child safety designs into new homes or by providing child safety features into existing homes.

This paper briefly concluded that the implementation of child safety in high-rise building in Malaysia still far compared to another countries. The implementation of child safety policy is needed to improve the quality of life through healthy environment and human well being for present and in the future time.

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