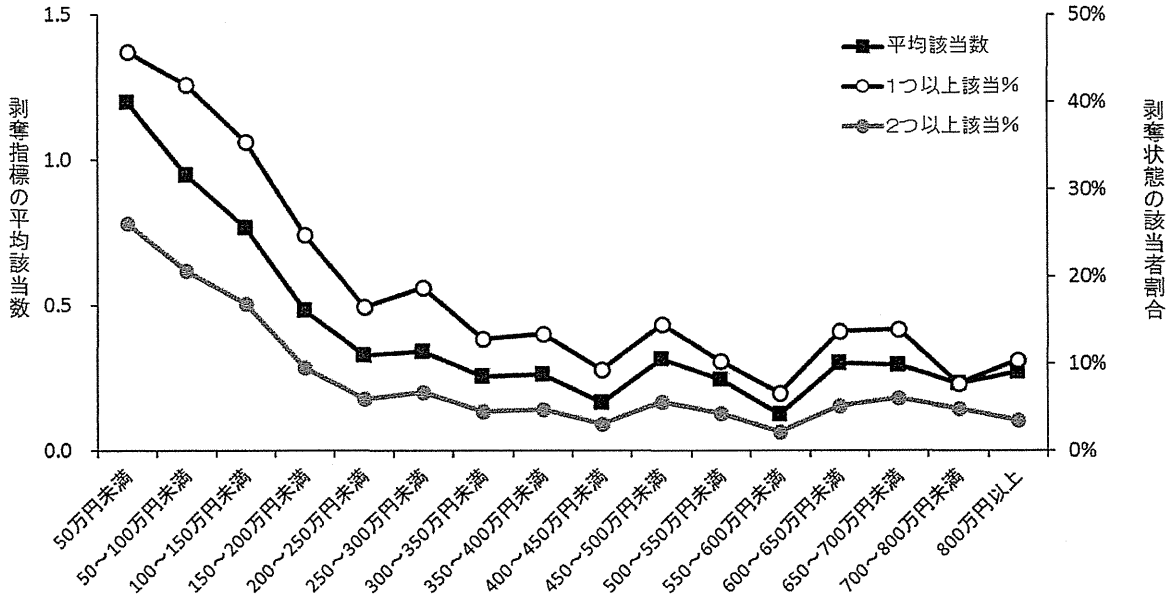

図1　等価所得段階による相対的剥奪得点と剥奪状態該当者割合の相違[a])

a) 剥奪状況および等価所得が不明なケースは除外している。

いという結果であった。同様に，貧困のみ群に対してはより高齢な層ほど該当しやすい傾向がみられたが，剥奪のみ群では年齢との間に有意な関連は認められなかった。一方で，他の変数を調整したうえでも，修学年数が短いこと，離別経験者であること，現在の住居が持ち家でないこと，抑うつ傾向にあること，治療疾患の有無とは関連がない点では，剥奪のみ群と貧困のみ群は共通していた。なかでも，住宅の所有状況と抑うつ傾向に関しては，貧困のみ群よりも剥奪のみ群の間でオッズ比がやや高く，持ち家でない人の方が2.73倍，抑うつ傾向にある方が1.85倍，剥奪のみ群に該当しやすいという結果であった。また，情緒的・手段的サポートがないことは，剥奪のみ群に対して有意な関連を示し，情緒的サポートがない方が1.27倍，手段的なサポートがない方が1.67倍，剥奪のみ群に該当しやすいという結果であった。

加えて，これらの変数は，剥奪と貧困の重複群との間で顕著に高いオッズ比が得られていた。たとえば，持ち家でない人の方が4.91倍，修学年数が短い人の方が3.13倍，抑うつ傾向にある人の方が2.86倍，離別経験者の方が2.36倍，手段的サポートがない人の方が1.97倍，情緒的サポートがない人の方が1.48倍，剥奪でも貧困でもない状態ではなく剥奪と貧困の重複群に該当しやすいというものであった。また，未婚であることは，剥奪と貧困の重複に対してのみ有意な関連を示しており，婚姻中の高齢者よりも未婚者の方が1.68倍，剥奪と貧困の重複に該当しやすいという結果であった。

なお，マルチレベル分析ではなく，市町村をダミー変数として投入したモデルも検討したが結果は同様であった。また，複数の剥奪指標該当者に着目して同様の解析を行ったところ（剥奪と貧困ともに非該当:61.8%，剥奪のみ該当:4.4%，貧困のみ該当:27.1%，剥奪と貧困に該当:6.8%），剥奪のみ該当者の特性は上記と概ね同様の結果であった。

4　性別による特性の相違

表5は，上記のモデルを男女別に解析した結果である。表4の結果と同様に，男女を分けても，変動効果はNullモデルと比べて小さくなっていなかった。解析の結果，年齢階層，修学年数，住宅

表4　相対的剥奪者の特性:マルチレベル・ロジスティック回帰分析[a,b)]

	剥奪のみ		貧困のみ		剥奪+貧困	
	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)
固定効果						
女　性（ref.=男　性）	0.79***	(0.71 - 0.88)	1.38***	(1.26 - 1.51)	1.32***	(1.18 - 1.48)
年齢（ref.=65-69歳）						
70 ～ 74歳	1.12	(0.98 - 1.27)	1.22**	(1.09 - 1.37)	1.30**	(1.12 - 1.50)
75 ～ 79歳	1.08	(0.94 - 1.25)	1.31***	(1.16 - 1.49)	1.31**	(1.11 - 1.53)
80 ～ 84歳	0.89	(0.74 - 1.06)	1.25**	(1.07 - 1.45)	1.36**	(1.13 - 1.64)
85歳以上	1.08	(0.86 - 1.35)	1.52***	(1.27 - 1.82)	1.36**	(1.08 - 1.70)
修学年数（ref.= > 9年以上）						
9年未満	1.70***	(1.53 - 1.89)	2.32***	(2.12 - 2.53)	3.13***	(2.79 - 3.50)
婚姻状態（ref.=婚姻中）						
死　別	0.95	(0.80 - 1.12)	1.07	(0.93 - 1.23)	1.13	(0.95 - 1.33)
離　別	1.45*	(1.06 - 1.99)	1.51**	(1.13 - 2.01)	2.36***	(1.74 - 3.19)
未　婚	0.70	(0.47 - 1.05)	1.15	(0.83 - 1.60)	1.68**	(1.18 - 2.38)
世帯構成（ref.=夫婦のみ）						
単　身	1.12	(0.92 - 1.37)	1.21*	(1.02 - 1.43)	1.14	(0.93 - 1.39)
子等と同居	0.86*	(0.75 - 0.99)	0.92	(0.82 - 1.03)	0.82**	(0.71 - 0.95)
その他	1.11	(0.92 - 1.34)	0.84	(0.71 - 1.00)	0.84	(0.68 - 1.04)
住宅所有（ref.=持ち家）						
持ち家以外	2.73***	(2.30 - 3.23)	2.14***	(1.80 - 2.54)	4.91***	(4.11 - 5.86)
治療疾患（ref.=なし）						
あ　り	1.06	(0.94 - 1.20)	1.04	(0.93 - 1.15)	0.94	(0.82 - 1.07)
抑うつ傾向（ref.=なし）						
あ　り	1.85***	(1.65 - 2.08)	1.48***	(1.33 - 1.64)	2.86***	(2.53 - 3.23)
情緒的サポート（ref.=あり）						
な　し	1.27*	(1.02 - 1.59)	1.17	(0.95 - 1.44)	1.48**	(1.18 - 1.86)
手段的サポート（ref.=あり）						
な　し	1.67***	(1.28 - 2.18)	1.10	(0.85 - 1.42)	1.97***	(1.53 - 2.56)
変動効果[c)]						
市町村（切片）	.236 (SE=.049)		.526 (SE=.080)		.726 (SE=.111)	

*** p<.001　** p<.01　* p<.05

a) 参照カテゴリーは剥奪でも貧困でもない群（n=9,504）. 剥奪状況・等価所得が不明なケースは除外した.

b) 各独立変数には不明をダミー変数として投入しているが本表では省略している

c) Nullモデルにおける市町村レベルの分散はそれぞれ下記の通り

剥奪のみ：.235（SE=.048）　貧困のみ：.571（SE=.086）　剥奪+貧困：.708（SE=.108）

の所有状況，治療疾患の有無と抑うつ傾向に関しては男女ともに概ね同様の傾向が得られていた。他方で，いくつかの変数については男女での相違も示唆された。離別経験者であることは，男女ともに剥奪と貧困との重複に強く関連していた（男性:OR=2.67，女性:OR=2.31）が，男性では剥奪のみに（OR=1.61），女性では貧困のみに（OR=1.93）も有意な関連が示された。また，未婚であることは，男性高齢者の間でのみ剥奪と貧困との重複に関連していた（OR=2.76）。死別経験者であることは，女性では貧困のみ，および，剥奪と貧困の重複に関連していたのに対し（それぞれOR=1.31，OR=1.27），男性では婚姻中の人よりも貧困のみに該当しにくいという結果（OR=0.69）であった。さらに，女性の間では，夫婦のみ世帯よりも子等と同居している世帯の方が，貧困のみ群（OR=0.82）および剥奪と貧困と重複群（OR=0.74）に該当しにくいという結果が得られていた。なお，単身世帯であることは，男女を分けたところ有意性は消失したが，女性では単身者の方が貧困のみに該当しやすい傾向があること（OR=1.24）が示唆された。

また，情緒的サポートがないことは，男性では剥奪と貧困の重複，剥奪のみ，貧困のみのいずれにも有意な関連が示された（それぞれOR=1.52，OR=1.36，OR=1.31）が，女性ではそうした関連

表5　男女別の相対的剥奪者の特性；マルチレベル・ロジスティック回帰分析[a,b)]

	剥奪のみ				貧困のみ				剥奪+貧困			
	男　性		女　性		男　性		女　性		男　性		女　性	
	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)
固定効果												
年齢（ref.=65~69歳）												
70 ～ 74歳	1.08	(0.91 - 1.28)	1.16	(0.95 - 1.40)	1.20*	(1.01 - 1.42)	1.25**	(1.07 - 1.47)	1.43**	(1.16 - 1.78)	1.20	(0.98 - 1.47)
75 ～ 79歳	1.18	(0.98 - 1.42)	0.96	(0.77 - 1.21)	1.39***	(1.16 - 1.67)	1.23*	(1.04 - 1.47)	1.42**	(1.12 - 1.79)	1.22	(0.98 - 1.52)
80 ～ 84歳	0.91	(0.72 - 1.16)	0.84	(0.63 - 1.12)	1.26*	(1.01 - 1.57)	1.24*	(1.01 - 1.53)	1.62**	(1.23 - 2.12)	1.21	(0.93 - 1.57)
85歳以上	1.54**	(1.14 - 2.07)	0.71	(0.49 - 1.02)	1.93***	(1.47 - 2.53)	1.29*	(1.01 - 1.65)	1.53*	(1.06 - 2.19)	1.27	(0.95 - 1.71)
修学年数（ref.= 9年以上）												
9年未満	1.49***	(1.30 - 1.71)	1.98***	(1.69 - 2.32)	2.56***	(2.25 - 2.92)	2.14***	(1.89 - 2.42)	3.18***	(2.70 - 3.75)	3.09***	(2.64 - 3.63)
婚姻状態（ref.=婚姻中）												
死　別	0.88	(0.67 - 1.16)	1.03	(0.82 - 1.29)	0.69**	(0.53 - 0.91)	1.31**	(1.10 - 1.55)	0.81	(0.59 - 1.12)	1.27*	(1.03 - 1.57)
離　別	1.61*	(1.02 - 2.54)	1.35	(0.86 - 2.12)	0.96	(0.56 - 1.65)	1.93***	(1.36 - 2.75)	2.67***	(1.66 - 4.30)	2.31***	(1.55 - 3.44)
未　婚	0.75	(0.42 - 1.34)	0.71	(0.40 - 1.27)	1.55	(0.88 - 2.73)	1.08	(0.72 - 1.62)	2.76***	(1.59 - 4.77)	1.23	(0.76 - 1.99)
世帯構成（ref.=夫婦のみ）												
単　身	1.22	(0.93 - 1.61)	1.03	(0.77 - 1.38)	1.03	(0.77 - 1.37)	1.24	(1.00 - 1.55)	1.03	(0.74 - 1.44)	1.17	(0.90 - 1.53)
子等と同居	0.83	(0.68 - 1.00)	0.89	(0.72 - 1.10)	1.06	(0.90 - 1.25)	0.82*	(0.70 - 0.97)	0.94	(0.76 - 1.17)	0.74**	(0.60 - 0.92)
その他	1.21	(0.94 - 1.55)	1.04	(0.78 - 1.38)	0.91	(0.70 - 1.19)	0.78*	(0.62 - 0.99)	0.85	(0.62 - 1.18)	0.82	(0.61 - 1.09)
住宅所有（ref.=持ち家）												
持ち家以外	2.79***	(2.23 - 3.49)	2.59***	(1.99 - 3.36)	1.97***	(1.53 - 2.55)	2.26***	(1.79 - 2.85)	3.76***	(2.88 - 4.91)	6.06***	(4.76 - 7.72)
治療疾患の有無（ref.=なし）												
あ　り	1.11	(0.94 - 1.30)	1.01	(0.84 - 1.23)	1.07	(0.92 - 1.25)	1.01	(0.88 - 1.17)	0.88	(0.73 - 1.06)	0.99	(0.82 - 1.19)
抑うつ傾向（ref.=なし）												
あ　り	1.94***	(1.66 - 2.26)	1.77***	(1.48 - 2.12)	1.58***	(1.35 - 1.84)	1.42***	(1.23 - 1.64)	3.30***	(2.77 - 3.94)	2.57***	(2.17 - 3.05)
情緒的サポート（ref.=あり）												
な　し	1.36*	(1.06 - 1.75)	0.87	(0.51 - 1.47)	1.31*	(1.01 - 1.70)	1.05	(0.72 - 1.53)	1.52**	(1.15 - 2.01)	1.41	(0.95 - 2.09)
手段的サポート（ref.=あり）												
な　し	1.76**	(1.23 - 2.51)	1.49	(0.98 - 2.27)	0.89	(0.57 - 1.39)	1.32	(0.95 - 1.83)	1.80**	(1.20 - 2.70)	2.18***	(1.54 - 3.08)
変動効果[c)]												
市町村（切片）	.146 (SE=.060)		.288 (SE=.066)		.565 (SE=.092)		.517 (SE=.082)		.772 (SE=.129)		.714 (SE=.113)	

*** p<.001　** p<.01　* p<.05

a) 参照カテゴリーは剥奪でも孤立でもない群（男性：n=5,005，女性：n=4,499）．剥奪状況・等価所得が不明なケースは除外した．

b) 各独立変数には不明をダミー変数として投入しているが本表では省略している

c) Nullモデルにおける市町村レベルの分散はそれぞれ下記の通り

剥奪のみ 男性：.158 (SE=.061)　女性：.204 (SE=.069) /　貧困のみ 男性：.597 (SE=.094)　女性：.564 (SE=.087) /剥奪+貧困 男性：.721 (SE=.118)　女性：.710 (SE=.111)

はみられなかった。手段的サポートがないことは，剥奪と貧困の重複群に対しては男女ともに有意であった（男性:OR=1.80，女性:OR=2.18），男性では剥奪のみ群に対しても有意な関連が示された（OR=1.76）

Ⅳ 考　察

所得の低さは貧困の要因の1つであっても，貧困の事象そのものを表すものではない〔阿部2006〕。本研究では，貧困状態を表す概念として，所得の低さに基づく相対的貧困に加えて，多次元的な生活様式の貧しさに基づく相対的剥奪という概念に着目し，高齢者の間での相対的剥奪者の割合と特性について分析を試みた。

分析の結果，第1に，相対的剥奪に関連する項目それぞれに該当する高齢者は数％程度だが，経済的な理由からライフラインを停止されたことのある高齢者や，親戚の冠婚葬祭に出席できない高齢者，医療機関への受診を抑制した高齢者が一定程度存在することが示された。貧困者の間で剥奪指標への該当者が顕著に多く，各項目該当者の平均等価所得も低くなっていたことは，本研究で使用した項目群の基準関連妥当性を示唆するものと考えられる。そのうえで，高齢者の27.6％がいずれかの剥奪指標に該当し，13.0％が複数の剥奪指標に該当していたという結果は，これまで報告されてきた知見と概ね一致するものである。日本の高齢者における相対的貧困者の割合が22.0％と報告されている〔OECD 2009〕ことを考慮すると，要介護認定を受けていない高齢者の間では，相対的貧困と同程度に相対的剥奪に該当する人々が存在しうることを示唆する結果といえる。なお，表には記載していないが，剥奪のみに該当した高齢者（n=2,049）のうち，住環境の劣悪さのみ該当者が36.4％，社会生活上の困難のみ該当者が20.7％，日用品の欠如のみ該当者が17.6％であり，残りの約25％は医療の受診抑制を含む複数の要素が欠如している状態であった。これらの人々は，従来の相対的貧困アプローチでは漏れていた貧困層といえる。

第2に，日本の高齢者を対象にした分析においても，先行研究〔Townsend 1979;阿部2006〕と同様に，剥奪状態へのリスクが急増する所得の閾値が存在することが示された。具体的には，高齢者がいる世帯において等価所得が200万円未満ないし150万円未満という状態になると相対的剥奪状態へのリスクが急激に高まっていた。使用した指標と対象者の相違から単純に比較することはできないが，本分析では世帯人数を調整した所得を使用しているため，本結果も既存の知見〔平岡2002;阿部2006〕と概ね矛盾しないものといえる。現在，単身の高齢者世帯の生活保護基準（生活扶助と住宅扶助のみ）は年間120万円程度であり，さらに生活保護基準額の引き下げが検討されている。老齢基礎年金が最低生活の保障機能として不十分であることはしばしば指摘されているが，本分析で得られた結果は，現行の生活保護基準よりも高い所得水準であっても，日本社会において標準的な生活のあり方とは質的に異なった状態に陥るリスクが高くなっていることを示唆するものである。防貧施策という点では，生活保護を受給していない等価所得200万円未満ないし150万円未満の高齢者世帯に対する税や介護・医療保険の自己負担額などの負担の重さに配慮する必要があるといえる。

第3に，相対的剥奪に該当した高齢者は相対的貧困者と異なる特性があることが示唆された。まず，年齢との関連については，先行研究の知見〔江口ら1974;平岡2002;山田ら2011〕と同様に，より高齢であるほど相対的貧困には該当しやすくなるのに対し，相対的剥奪のみには系統的な関連はみられなかった。これは，相対的貧困の指標である所得が退職，死別，健康問題などの加齢に伴う状況的な変化や年金制度の成熟と関連が深いものであるのに対し，相対的剥奪という概念が着目する社会生活上の必需項目は過去からの蓄積によって形成されるものであることを反映した結果と考えられる。加えて，高齢期に持ち家でないことが相対的貧困よりも相対的剥奪に対して密接に関連しているという結果も，相対的剥奪が所得の乏しさではなく生活資源の乏しさに着目した概念である

ことを反映したものといえる。

そのうえで，本研究によれば，相対的剥奪には女性ではなく，男性高齢者の方が該当しやすいという知見が新たに示された。さらに，死別経験は女性でのみ貧困および貧困と剥奪の重複に関連し，離別経験は男性では相対的剥奪，女性では相対的剥奪ではなく相対的貧困と関連するという相違がみられた。まず，死別経験に関しては，女性にとって高齢期における配偶者との死別は，年金制度上，世帯所得の低下につながること〔山田ら2011〕が示されており，本結果と一致するものである。なお，男性で逆の傾向が示されたことは，配偶者との死別による収入減少が生じにくいことを反映したものかもしれない。離別経験に関しては，女性にとって配偶者との離別はその後の貨幣的な貧困に結びつきやすいことが知られており〔内閣府男女共同参画会議2011b〕，本結果はそれらと矛盾しないものである。一方，現在の多くの男性高齢者にとって配偶者との離別は，収入面での不利にはつながらないが，たとえば，「高齢者の生活と意識に関する国際比較調査〔内閣府2005〕」によれば，炊事・洗濯・掃除などの家事を自分がしている男性高齢者は約1割に過ぎない。その結果として，男性の間では，配偶者との離別が一般的な社会生活を営むための資源を獲得・維持するうえでの困難につながったものと考えられる。いずれにしても，本結果は，所得の乏しさと生活資源や様式の乏しさが重複する人々もいるが，相対的貧困と相対的剥奪が貧困の異なる側面を捉えており，両概念で把握可能な対象層に相違があることを示唆するものといえる。

一方，治療疾患の有無については，相対的貧困に対しても相対的剥奪に対しても有意な関連は認められなかった。これは，医療保険の充実などによる社会政策が，高齢期の疾病に伴う貧困状態へのリスクを軽減する機能を果たしていることを示唆するものである。しかし，貧困のみ該当者と比べて，剥奪のみ該当者および剥奪と貧困の重複者の方が情緒的および手段的サポートがないこと，抑うつ傾向にあることと強い関連があることも示されていた。本研究では，貧困のみと剥奪のみでどちらの方が貧困状態としてより深刻であるかは明らかにできていないが，貧困層を物的・環境的な生活様式の指標から把握することにより，従来の貨幣指標に基づく把握よりも健康やソーシャル・サポートにおいてより不利な層を抽出できることを示唆する結果が得られたといえる。相対的剥奪指標の構成は複雑であり，必ずしも国内で広く普及した概念ではないが，本結果は多次元的な不利を抱えた貧困層を把握するうえでは相対的剥奪という概念が有益であることを示唆するものと考えられる。

加えて，本分析では，相対的剥奪のみ該当者と比べて，相対的剥奪と相対的貧困の重複者の方が，手段的サポートと情緒的サポートの乏しさ，および，抑うつ傾向と強く関連し，修学年数の短さと離別経験者や未婚者であること，現住居が持ち家でないといったライフコース上の社会経済的な不利とも密接に関連しているという結果が得られていた。とくに，男性高齢者の場合，未婚であると貧困と剥奪が重複した状態に至るリスクが約2.8倍も高くなっていた。既にさまざまな社会保障制度が整備されているが，これらの結果は，現行の制度では標準的なライフコースからの逸脱によって貧困状態に陥るリスクを緩衝しきれていないことを示唆するものといえる。相対的剥奪者の半数程度は長期的な貧困を経験している〔Whelan et al. 2003;岩田ら2004〕ともいわれており，相対的貧困と相対的剥奪を重複した状態が過去からの蓄積によって形成されている要素が強いとすれば，その改善には「人生前半の社会保障〔広井2006〕」がより重要になるものと考えられる。

以上のように，本研究では，物的・環境的な生活様式指標で構成される相対的剥奪という概念に着目することにより，これまで数多く検討されてきた相対的貧困とは異なる貧困層を把握しうることが示唆された。相対的貧困が所得という簡便に把握でき比較可能性に優れた概念であるのに対し，相対的剥奪は複雑な指標構成であり，比較可能性にも限界がある。他方で，相対的剥奪は，社会生活における多次元的な資源に着目している点で，実際の生活水準に密着した概念であり，当該

社会における貧困者を適切に表している可能性がある。実際に，欧州連合では，貧困対策の政策目標として相対的貧困だけでなく相対的剥奪にも言及している〔European Commission 2011〕。日本においても従来の貨幣的な指標に基づく相対的貧困だけでなく，多次元的な生活様式の貧しさから高齢者の貧困を捉え直す必要があると考えられる。

さいごに，本分析の限界として以下の3点があげられる。第1に，実際の社会保障基準として使用するためには相対的剥奪指標の精緻化が必要である。本研究では，項目選定を一般市民に問う合意基準アプローチ〔Mack et al. 1986;Gordon et al. 2000;阿部2006;Saunders 2008〕によって採用された項目を参考にしているが，本研究で使用した指標のみをもって日本社会で高齢者が必要とするものを網羅しているわけではない。このため，本研究で検討した剥奪状態の全てに公的扶助が必要であるとはいえない点には留意する必要がある。第2に，本研究で使用した調査は，貧困問題を主たる課題にした調査ではなかったため，資産に関する変数が含められていない。高齢者は収入が少なくても資産額が大きいため，理論的には相対的剥奪の把握に際して資産に関する項目も加える必要がある。しかし，そうした限界はあるものの，相対的剥奪へのリスクが高まる等価所得の閾値が見いだされた点は，相対的剥奪という概念が国内の貧困線を検討するアプローチとしても応用可能性があることを示唆するものと考えられる。第3に，本調査の回収率は66.3％となっており，この種の調査では決して低くはないが，より深刻な貧困者や剥奪者ほど調査から脱落している可能性がある。また，本結果は，全国の代表サンプルではないため，地域的な偏りが生じている可能性も否定できない。今後，他の調査データによっても再度検証される必要がある。

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Research Article

Factors Associated with Falls in Community-Dwelling Older People with Focus on Participation in Sport Organizations: The Japan Gerontological Evaluation Study Project

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Objective. Promoting participation in sport organizations may be a population strategy for preventing falls in older people. In this study, we examined whether participation in sport organizations is associated with fewer falls in older people even after adjusting for multiple individual and environmental factors. *Methods.* We used the Japan Gerontological Evaluation Study data of 90,610 people (31 municipalities) who were not eligible for public long-term care. Logistic regression analysis was performed, with multiple falls over the past year as the dependent variable and participation in a sport organization as the independent variable, controlling for 13 factors. These included individual factors related to falls, such as age and sex, and environmental factors such as population density of the habitable area. *Results.* A total of 6,391 subjects (7.1%) had a history of multiple falls. Despite controlling for 13 variables, those who participated in a sport organization at least once a week were approximately ≥20% less likely to fall than those who did not participate at all (once a week; odds ratio = 0.82 and 95% confidence interval = 0.72–0.95). *Conclusion.* Participation in a sport organization at least once per week might help prevent falls in the community-dwelling older people.

1. Introduction

Prevention of falls in older people is a major global public health concern [1]. It has been reported that, in older people ≥65 years of age, 1 in 3 falls at least once a year. Injuries from falls can also lead to reduced physical function [2–4]. In Japan, the nation with the highest proportion of older citizens [5], falls and fractures are one of 10 cases requiring long-term care among older people aged ≥65. They are among the five main causes for older people's long-term care [6].

Previous studies have reported several factors associated with the risk of falling, including old age [7], female gender [8, 9], history of falls [10, 11], vision problems [12], depression [13, 14], and reduced strength and balance [15]. It has also been shown that increasing physical activity through exercise interventions that include strength and balance training can

prevent falls [3, 16, 17]. However, fall-prevention programs that focus on strength and balance training have poor cost-effectiveness [18]. Since 2006, many municipalities in Japan have spent large amounts of money on fall-prevention programs using high-risk approaches intended for early identification of high-risk individuals. However, numerous issues have been exposed, such as the cost of screening subjects and the fact that few subjects participate in the recommended programs after being screened. There have thus been calls to switch from a high-risk strategy to a population strategy.

Therefore, this study focused on physical activities that community-dwelling older people can easily participate in during their everyday lives as a population approach; specifically, we analyzed the relationship between participation in community sport organizations and the incidence of falls. Participation in sport organizations is linked to fall prevention through direct effects such as increase in physical activity and improving strength and balance [19, 20]. Participation in sport organizations is also thought to indirectly protect health by providing social support and through social networks [21]. Previous studies have found that participation in sport organizations reduces the risk of dementia [22] and stroke [23], as well as reducing functional decline [24]. Therefore, the incidence of falls in older people who participate in nearby sport organizations would be lower than in those who do not. However, to our knowledge, no studies have verified this connection.

The purpose of this study was to verify if population strategies for promoting participation in sport organizations prevent falls in community-dwelling older people and to examine whether the connection between fewer falls and participation in sport organizations among this population is evident after controlling for multiple individual and environmental factors, particularly depression and motor abilities.

2. Materials and Methods

2.1. Study Sample. The present analysis was based on a subset of the Japan Gerontological Evaluation Study (JAGES) project date. The JAGES project is an ongoing prospective cohort study investigating factors associated with the loss of health related to functional decline or cognitive impairment among individuals aged ≥65 years. In 2010-2011, responses were received by post from 112,123 people in 31 municipalities across Japan (response rate: 66.3%). We further excluded those who did not provide information on age or sex (n = 12,627) and history of falls (n = 4,527), and those who needed assistance in activities of daily living (ADL) (n = 4,359). Therefore, the current study population consisted of 90,610 subjects. If the respondents did not respond to other variables, the corresponding observations were assigned to the "missing" category.

Ethical approval for the study was obtained from the Nihon Fukushi University Ethics Committee.

2.2. Outcome Variable. History of falls was ascertained by asking, "Have you had any falls over the past year?" with possible answers of "multiple times," "once," or "none." Multiple falls were used as an outcome (the incidence of falls), and the last 2 categories were combined because previous studies have found that single fallers are more similar to nonfallers than to recurrent fallers on a wide range of medical and physical risk factors [25, 26].

2.3. Main Predictors. Participation in a sport organization was ascertained by asking, "How often do you participate in a sport group or club?" with possible answers of "almost every day," "2 or 3 times a week," "once a week," "once or twice a month," "several times a year," and "I do not engage in any sport activities," and was categorized into the following 6 groups: "almost every day," "2 or 3 times a week," "once a week," "once a month or less," "not participating," and "missing." We defined participation in a sport organization as participation in a sport group or club in the community base in this study.

2.4. Covariates. On the basis of the results of previous studies [9, 15, 27–29], we selected the covariates that may correlate with falls. First, we used the basic characteristics such as age, sex, and socioeconomic status (educational attainment and annual equivalent income). Educational attainment was ascertained by asking, "How many years of formal education have you had?" with possible answers of "less than 6 years," "6–9 years," "10–12 years," "more than 13 years," and "other." We divided the responses into 4 groups: "less than 6 years," "6–9 years," "10–12 years," "more than 13 years," and we included "other" in the same category as "missing" [28, 30]. To adjust household income for household size, the annual equivalent income was calculated by dividing the household income by the square root of the number of household members and was categorized into 3 groups: ≥2.5 million yen (high), less than 1.5–2.5 million yen (middle), and <1.5 million yen (low).

Physical traits used included current medical history related to falls (stroke, osteoporosis, joint disease/neuralgia, injury/fracture, mental illness, impaired vision, and impaired hearing) and physical ability. Physical ability was ascertained by asking, "Do you go upstairs without holding on to the handrail or the wall?" and "Do you get up out of a chair without holding anything?" with possible answers of "Yes" or "No." Depression was assessed with the short version of the Geriatric Depression Scale-15 developed for self-administration in the community using a simple yes/no format [31] and was categorized into 3 groups: 0–4 (no), 5–9 (mild), and 10–15 (moderate to severe) [32].

For lifestyle habits, we used walking in minutes/day and frequency of outings. Walking in minutes/day was categorized into 2 groups: <30 minutes (low) and ≥30 minutes (high) [33]. Frequency of outings was categorized into 3 groups: almost every day, 2-3 times a week, and once a week or less [28].

For environmental characteristics, we used the surrounding environment and population density variation. The surrounding environment was ascertained by asking, "Are parks or foot paths suitable for exercise or walking within 1 km from your home?" and "Are locations difficult for walking, such as

hills or steps, within 1 km from your home?" with possible answers of "many," "some," "few," and "none." Both items were categorized into 2 groups: "many" or "some" (Yes) and "few" or "no" (No), and we included "other" in the same category as "missing." In order to determine whether geographical positioning was a significant factor, the 31 municipalities were classified into 3 groups: urban (densities over 1,500 people per square kilometer), semiurban (densities between 1,000 and 1,500 people per square kilometer), and rural (densities below 1,000 people per square kilometer) [34].

2.5. Statistical Analysis. We performed logistic regression to examine the association between participation in a sports organization and the incidence of falls. We calculated the odds ratios (OR) and 95% confidence intervals (95% CI) for the incidence of falls. First, the univariate ORs were calculated for participation in a sport and each covariate (crude OR). Second, 3 logistic regression models were constructed. In model 1, age, sex, educational attainment, and annual equivalent income were added to the univariate models for participation in a sport organization to adjust for sociodemographics. In model 2, current medical history related to falls (stroke, osteoporosis, joint disease/neuralgia, injury/fracture, mental illness, impaired vision, and impaired hearing), physical ability, depression, walking in minutes/day, and frequency of outings were added to model 1 to adjust for sociodemographics. In model 3, surrounding environment and population density variation were added to model 2 to adjust for sociodemographics. All statistical analyses were conducted using IBM SPSS statistical software Ver.21 (IBM Corp.).

3. Results

Table 1 shows the demographic and health characteristics of all study respondents. These comprised 41,912 men (46.3%) and 48,698 women (53.7%), and the mean age was 73.9 ± 6.1 years. A total of 6,391 (7.1%) of the 90,610 respondents reported the incidence of falls.

3.1. Frequency of Participation in Sport Organizations and Fall Incidence. Table 2 shows the frequency of participation in a sport organization. There were 53,645 subjects (59.2%) in the not participating group, 7,020 subjects (7.7%) in the once a month or less group, 5,322 subjects (5.9%) in the once a week group, 6,508 subjects (7.2%) in the 2 or 3 times a week group, 1,715 subjects (1.9%) in the almost every day group, and 16,400 subjects (18.1%) in the missing group. The percentage of subjects who reported the incidence of falls was 7.7% in the not participating group, 5.2% in the once a month or less group, 4.3% in the once a week group, 4.4% in the 2 or 3 times a week group, 3.4% in the almost every day group, and 8.1% in the missing group. The univariate model showed that, with the not participating subjects as a reference, the OR for subjects with once a month or less participation was significantly lower at 0.66 (95% CI 0.59–0.73) and was even lower for the subjects with once a week participation at 0.55 (95% CI 0.48–0.62); for subjects with 2 or 3 times a week participation, the OR was lower at 0.55 (95% CI 0.49–0.62), and for subjects with almost every day participation OR was at 0.43 (95% CI 0.33–0.56).

Table 3 shows the OR and 95% CI for the incidence of falls associated with the frequency of participation in a sport organization, in the adjusted models. After adjusting for base characteristics (model 1) and setting the not participating subjects as the reference, the OR for the subjects with once a week participation was significantly lower at 0.66 (95% CI 0.57–0.75) and was even lower for those with 2 or 3 times a week participation at 0.63 (95% CI 0.55–0.71), and the OR for subject with almost every day participation was at 0.49 (95% CI 0.38–0.64). Similar results were observed when we added physical traits, depression, and life habits to the covariates in model 1 (model 2, once a week: OR = 0.82, 95% CI 0.71–0.94, 2 or 3 times a week: OR = 0.81, 95% CI 0.71–0.92, and almost every day: OR = 0.66, 95% CI 0.51–0.87) and added environmental characteristics to the covariates in model 2 (model 3, once a week: OR = 0.82, 95% CI 0.72–0.95, 2 or 3 times a week: OR = 0.81, 95% CI 0.72–0.92, and almost every day: OR = 0.67, 95% CI 0.52–0.88). This indicates that those who participated in a sport organization at least once a week had approximately 20% lower incidence of falls than those who did not participate at all. Moreover, lower incidence of falls was associated with more frequent participation in a sport organization.

3.2. Fall-Related Factors and Fall Incidence. The univariate models showed that older age, low educational status, low annual equivalent income, having current medical history, low physical ability, depression, <30 min walking time, once a week or less frequency of outings, not having parks or foot paths suitable for exercise or walking, having locations difficult for walking close to home, and living in the local government were each associated with the incidence of falls (Table 1). In the fully adjusted model 3, older age, male gender, low educational status, having current medical history, low physical ability, depression, less than 30-minute walking time, having locations difficult for walking close to home, and living in the local government were each associated with the incidence of falls. However, no significant association was observed between the incidence of falls and annual equivalent income, frequency of outings, and availability of parks or foot paths suitable for exercise or walking after adding all covariates in the logistic regression model (Table 3).

4. Discussion

The main findings of this study were as follows: (1) even after controlling for 10 individual factors, including age, amount of physical activity, and depression, and 3 environmental factors such as habitable population density, the risk of falls was approximately ≥20% lower in people who participated in sport organizations once a week than people who did not participate in sport organizations; (2) lower incidence of falls was associated with more frequent participation in a sport organization; and (3) the influence of sex and socioeconomic

Table 1: Characteristics and univariate associations of falls with covariates.

	Total	Fallers		Crude OR (95% CI)
	n	*n*	(%)	
N	90,610	6,391		
Age (years)				
65–69	26,425	1,185	(4.5)	1.00
70–74	26,523	1,504	(5.7)	1.28 (1.18–1.38)**
75–79	20,176	1,615	(8.0)	1.85 (1.72–2.00)**
80–84	11,773	1,310	(11.1)	2.67 (2.46–2.89)**
≥85	5,713	777	(13.6)	3.35 (3.05–3.69)**
Sex				
Male	41,912	2,893	(6.9)	1.00
Female	48,698	3,498	(7.2)	1.04 (0.99–1.10)
Educational attainment (years)				
≥13	15,282	792	(5.2)	1.00
10–12	29,845	1,679	(5.6)	1.09 (1.00–1.19)
6–9	39,259	3,247	(8.3)	1.65 (1.52–1.79)**
<6	2,268	341	(15.0)	3.24 (2.83–3.71)**
Missing	3,956	332	(8.4)	1.68 (1.47–1.91)**
Equivalent income (yen)				
≥250	23,074	1,280	(5.5)	1.00
1,500,000–2,500,000	29,696	1,798	(6.1)	1.10 (1.02–1.18)*
<1,500,000	22,045	1,865	(8.5)	1.57 (1.46–1.69)**
Missing	15,795	1,448	(9.2)	1.72 (1.59–1.86)**
Present illness related to falls[$]				
No	40,739	2,265	(5.6)	1.00
Yes	28,244	3,193	(11.3)	2.17 (2.05–2.29)**
Missing	21,627	933	(4.3)	0.77 (0.71–0.83)**
Physical ability				
Go upstairs without holding rail or wall				
Yes	74,970	3,933	(5.2)	1.00
No	14,603	2,354	(16.1)	2.38 (2.26–2.51)**
Missing	1,037	104	(10.0)	2.23 (1.79–2.77)**
Stand up from the chair without any aids				
Yes	54,696	2,592	(4.7)	1.00
No	34,991	3,707	(10.6)	3.47 (3.29–3.67)**
Missing	923	92	(10.0)	2.01 (1.64–2.47)**
Depression				
No	53,912	2,516	(4.7)	1.00
Mild	15,509	1,624	(10.5)	2.39 (2.24–2.55)**
Moderate to severe	5,144	880	(17.1)	4.22 (3.88–4.58)**
Missing	16,045	1,371	(8.5)	1.91 (1.78–2.04)**
Walking in min/day				
≥30	58,993	3,481	(5.9)	1.00
<30	28,627	2,623	(9.2)	1.61 (1.53–1.70)**
Missing	2,990	287	(9.6)	1.69 (1.49–1.92)**
Frequency of outings				
Almost every day	46,063	2,546	(5.5)	1.00
2-3 times a week	25,421	1,845	(7.3)	1.34 (1.26–1.42)**
Once a week or less	15,181	1,633	(10.8)	2.06 (1.93–2.20)**
Missing	3,945	367	(9.3)	1.75 (1.56–1.97)**

Table 1: Continued.

	Total	Fallers		Crude OR (95% CI)
	n	*n*	(%)	
Neighborhood built environment				
Parks and walkways for exercise				
Yes	61,667	3,937	(6.4)	1.00
No	24,071	1,908	(7.9)	1.26 (1.19–1.34)**
Missing	4,872	546	(11.2)	1.85 (1.68–2.03)**
Difficult to walk on a slope or steps				
Yes	35,787	3,106	(8.7)	1.00
No	50,321	2,814	(5.6)	0.62 (0.59–0.66)**
Missing	4,502	471	(10.5)	1.23 (1.11–1.36)**
Population density (person per square kilometer)				
Urban	36,878	2,025	(5.5)	1.00
Semiurban	20,327	1,429	(7.0)	1.30 (1.21–1.40)**
Rural	33,405	2,937	(8.8)	1.66 (1.56–1.76)**

OR: odds ratio; CI: confidence interval.
[$] Stroke, osteoporosis, joint disease/neuralgia, injury/fracture, mental illness, impaired vision, and impaired hearing.
**$P < 0.01$, *$P < 0.05$.

Table 2: Univariate associations of falls with participation in sport organizations.

	Total	Fallers		Crude OR (95% CI)
	n	*n*	(%)	
N	90,610	6,391		
Frequency of participation in sport organizations				
Not participating	53,645	4,121	(7.7)	1.00
Once a month or less	7,020	363	(5.2)	0.66 (0.59–0.73)**
Once a week	5,322	231	(4.3)	0.55 (0.48–0.62)**
2 or 3 times a week	6,508	286	(4.4)	0.55 (0.49–0.62)**
Almost every day	1,715	59	(3.4)	0.43 (0.33–0.56)**
Missing	16,400	1,331	(8.1)	1.06 (1.00–1.13)

OR: odds ratio; CI: confidence interval.
**$P < 0.01$.

factors on falls was found to be different from the results of the previous studies.

First, this study sought to verify whether participating in sport organizations was linked to incidence of falls even after statistically controlling for multiple individual and environmental factors. The results of models 1–3 showed that people who participated in sport organizations at least once a week were less likely to fall compared to people who did not. This is thought to be through direct effects such as improvement in strength and balance [19, 20] that are associated with lower risk of falls [15]. It has been reported that exercising at least once per week for at least 2 hours is necessary in fall-prevention programs that have been shown to be effective [16]. In other words, it is highly likely that people who fulfill these conditions by participating in sport organizations instead of specialized fall-prevention programs fall less frequently.

The result shows that lower incidence of falls was associated with more frequent participation in a sport organization. A person with a higher participation frequency would demonstrate greater physical activity and exercise at a higher intensity during a session. In addition, Sherrington et al. mentioned that increasing the total hours of the exercise program to over 50 hours would lower the incidence of falls in older people [17]. Therefore, even if the period of participation in a sports organization is shorter, some participants with more participation frequency would satisfy this condition or requirement. However, those who participate in an organization often participate for a long duration. For that reason, the participation could be over 50 hours in total even if the frequency is not necessarily once or more a week; however, from a long-term standpoint, the exercise requirement for prevention is considered as secured. Therefore, not only the frequency but also the duration of one session and the exercise intensity are important.

On the other hand, previous studies have reported that the injury by falls causes declined physical functioning [2, 4]. It is also possible that the results at this time indicate an apparent relationship of falls with increased physical activity and not with participation in a sports organization. Thus, we have conducted analyses with adjustment for walking in minutes/day and the frequency of outing as an index of

Table 3: Multivariate adjusted OR and 95% CI for the associations of falls.

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Frequency of participation in sport organizations			
Not participating	1.00	1.00	1.00
Once a month or less	0.77 (0.69–0.87)**	0.94 (0.84–1.05)	0.91 (0.81–1.02)
Once a week	0.66 (0.57–0.75)**	0.82 (0.71–0.94)**	0.82 (0.72–0.95)**
2 or 3 times a week	0.63 (0.56–0.71)**	0.81 (0.71–0.92)**	0.81 (0.72–0.92)**
Almost every day	0.49 (0.38–0.64)**	0.66 (0.51–0.87)**	0.67 (0.52–0.88)**
Age (years)			
65–69	1.00	1.00	1.00
70–74	1.23 (1.13–1.33)**	1.12 (1.03–1.21)*	1.10 (1.01–1.19)*
75–79	1.68 (1.55–1.82)**	1.29 (1.19–1.40)**	1.25 (1.16–1.36)**
80–84	2.32 (2.13–2.52)**	1.57 (1.43–1.71)**	1.50 (1.38–1.64)**
≥85	2.74 (2.48–3.02)**	1.65 (1.49–1.83)**	1.57 (1.42–1.75)**
Sex			
Male	1.00	1.00	1.00
Female	0.95 (0.91–1.01)	0.79 (0.75–0.84)**	0.79 (0.75–0.84)**
Educational attainment (years)			
≥13	1.00	1.00	1.00
10–12	1.04 (0.95–1.13)	0.99 (0.91–1.08)	0.98 (0.90–1.07)
6–9	1.37 (1.26–1.49)**	1.24 (1.14–1.35)**	1.22 (1.12–1.33)**
<6	1.86 (1.61–2.14)**	1.52 (1.31–1.75)**	1.47 (1.27–1.71)**
Equivalent income (yen)			
≥250	1.00	1.00	1.00
1,500,000–2,500,000	1.07 (0.99–1.15)	1.01 (0.94–1.09)	1.00 (0.92–1.08)
<1,500,000	1.29 (1.20–1.40)**	1.08 (1.00–1.17)*	1.02 (0.94–1.10)
Present illness related to falls[$]			
No		1.00	1.00
Yes		1.59 (1.50–1.69)**	1.57 (1.48–1.67)**
Physical ability			
Go upstairs without holding rail or wall			
Yes		1.00	1.00
No		1.45 (1.36–1.53)**	1.44 (1.36–1.53)**
Stand up from the chair without any aids			
Yes		1.00	1.00
No		2.02 (1.89–2.14)**	1.98 (1.86–2.11)**
Depression			
No		1.00	1.00
Mild		1.79 (1.68–1.92)**	1.78 (1.66–1.90)**
Moderate to severe		2.72 (2.49–2.97)**	2.68 (2.45–2.93)**
Walking in min/day			
≥30		1.00	1.00
<30		1.09 (1.03–1.15)**	1.09 (1.03–1.16)**
Frequency of outings			
Almost every day		1.00	1.00
2-3 times a week		0.99 (0.93–1.06)	0.96 (0.90–1.03)
Once a week or less		1.11 (1.04–1.20)**	1.03 (0.96–1.11)
Neighborhood built environment			
Parks and walkways for exercise			
Yes			1.00
No			1.03 (0.97–1.09)

Table 3: Continued.

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Difficult to walk on a slope or steps			
Yes			1.00
No			0.74 (0.70–0.79)**
Population density (people per square kilometer)			
Urban			1.00
Semiurban			1.23 (1.14–1.32)**
Rural			1.43 (1.35–1.53)**

OR: odds ratio; CI: confidence interval; $stroke, osteoporosis, joint disease/neuralgia, injury/fracture, mental illness, impaired vision, and impaired hearing.
Model 1 is adjusted for age, sex, educational attainment, and equivalent income.
Model 2 is adjusted for the covariates in Model 1 plus physical ability, depression, walking in minute/day, and frequency of outings.
Model 3 is adjusted for the covariates in Model 2 plus neighborhood built environment and population density.
**$P < 0.01$, *$P < 0.05$.

physical activity in this study. The results showed that the OR of the frequency of participation in a sport organization increased significantly from 0.66 to 0.82 for those with once a week participation, from 0.63 to 0.81 for 2 or 3 times a week, and from 0.49 to 0.66 for those with almost every day participation. Street et al. reported that participating in sport organizations not only influences physiological health by increasing the amount of physical activity but also works via social networks and social support [21]. It is therefore also possible that participation in sports organizations indirectly protects health through social support and social networks. Further, a 4-year follow-up cohort study on 11,581 people by Kanamori et al. suggested an indirect effect whereby, among people with the same exercise frequency, those who did not participate in sport organizations had a 1.33-fold higher hazard ratio for being certified to require long-term care compared to those who did [24]. The above indicates that people who participate in sport organizations get more physical activity than people who do not, which leads to less likelihood of falling through direct effects such as increased strength and balance as well as indirect effects such as the intervention of social networks and social support.

Next, we will discuss the relationship between environmental factors and the results of this analysis. Previous studies have reported that participation rates in sport organizations are higher in urban areas [35] and that exercise frequency is greater among people who live near parks or other areas suitable for exercise [36]. However, it is possible that these relationships are only apparent due to confounding factors. Therefore, we controlled for habitable population density and variables regarding the neighborhood environment. The results showed that, in the built environment, a significant relationship did not exist with the presence of facilities such as parks and the OR for falls of people living in communities without slopes or steps was low at 0.74. Further, in the community characteristics observed through population density, the OR of falls was significantly higher in rural areas (1.43) than in urban areas. There was little change in the OR for participation in sport organizations even compared to models 2 and 3 including these environmental variables, which shows that the confounding effect of these environmental characteristics is small. The results suggest that increasing the number of participants in sport organizations could reduce falls even after considering for environmental and individual factors such as depression and motor ability. This supports the significance of further research into population strategies via community initiatives such as policies that promote participation in sport organizations (participatory organizations), which could serve as fall-prevention measures to complement or substitute for primary or secondary prevention. Tinetti et al. [37] conducted a large interventional study in 2 communities with around 100,000 people aged ≥70 years. In addition to individual interventions, they used soft methods such as placing posters on buses and other means of public transport, handing out pamphlets, making appeals through media such as radio and television, and holding seminars. Through this, they found that fall-related injuries and medical expenses declined in the intervention community compared to the control community. Further research on fall-prevention policies that employ population strategies to promote participation in sport organizations is needed.

Many previous studies [15, 27, 38] have examined factors related to falls, particularly a systematic review of 74 cohort studies by Deandrea et al. [9]. This study obtained similar results to past research regarding age, physical characteristics, and mental characteristics. However, we obtained different results regarding gender, annual equivalent income, and frequency of outings. One very likely reason for these differences was that we considered and controlled for variables simultaneously. For example, regarding the link between gender and the incidence of falls, Deandrea et al. reported that nearly all the studies they reviewed found being female is associated with an increased risk of falls [9], with the same being reported in other past studies [38]. However, while many of these studies had sample sizes in the thousands, none of the analyses were controlled for depression. This study found a significant relationship between gender and the incidence of falls both in the univariate analysis and in model 1, which controlled for age and gender. However, in model 2, which controlled for psychological factors including depression, being female was found to have a significantly

lower OR with regard to the incidence of falls compared to being male. Women are at higher risk of depression than men [39–41], and depression has been shown to be a risk factor for falls [13, 14, 42]. In other words, controlling for depression, which was not done in previous studies, produces results indicating that women are less likely to fall than men.

A study from South Australia on the relationship of history of falls with socioeconomic factors reported that many people with at least a university degree had not experienced a fall in the past 1 year [43]. Moreover, Fabre et al. pointed to several pieces of evidence in reporting that many years of education and higher incomes were linked to a lower risk of falling [27]. Matsuda in an analysis of about 30,000 community-dwelling older people in Japan also reported higher ratios of people who had experienced a fall among subjects with low levels of education and income [29]. Examination of these studies, however, reveals that few simultaneously included both years of education and income in their analyses. The univariate analysis in this study, as well as the multivariate analyses in models 1 and 2 that simultaneously included years of education and annual equivalent income, showed significantly higher likelihood of falling in both people with few years of education and those with low annual equivalent incomes. People of low socioeconomic status become depressed more easily, get less physical activity [44, 45], and often exhibit shorter walking times [29]. Since people with depression and lower levels of physical activity are at risk of falling [13, 14, 42], it is possible that socioeconomic factors are linked to falls via differences in the incidence of depression and amount of physical activity. After controlling for depression, the amount of physical activity, and other individual characteristics in model 2, the OR of the socioeconomic factors declined significantly, from 1.86 to 1.52 for <6 years of education and from 1.29 to 1.08 for equivalent annual income <1.5 million yen. In other words, while factors such as depression and physical activity were found to participate in the relationship between socioeconomic factors and the incidence of falls in this study, the existence of other routes is suggested. In model 3, which controlled for environmental factors, only the annual equivalent income declined significantly, suggesting that years of education are more strongly linked to falls than to income.

While the advantages of this study are that it used a relatively large amount of data and controlled for a large number of variables, it has several limitations. First, since this was a cross-sectional analysis, we merely showed that a relationship exists between participation in sport organizations and the incidence of falls; we did not eliminate the effect of an opposite causal relationship, whereby falls prevent people from participating in sport organizations. Further, the influence of the subjects' objective motor functions or unknown confounding factors was not eliminated. In the future, we hope that a longitudinal research using 2 time points will be pursued to determine a causal relationship. Second, the environmental variables in this study were obtained from self-administered questionnaires. It is becoming increasingly possible to obtain objective information on slopes, differences in elevation, and other features from geographic information systems (GIS); it would be desirable to use such information in future investigations. Third, in this study, we did not investigate the duration of one session and intensity of the activity. Thus, if the promotion of participation in sport organizations is pursued as a population strategy to prevent falls, we also need to consider the influence of the duration and intensity of the activity, in addition to the frequency of participation in sports. Fourth, the results of population strategies must eventually be verified through community-intervention studies.

5. Conclusion

This study analyzed the data of 90,610 community-dwelling older people individuals. Even after adjusting for multiple factors it was found that the risk of falls was approximately ≥20% lower in people who participated in sport organizations at least once per week than those who did not participate at all. This suggests that primary prevention through population strategies such as policies that promote participation in sport organizations could be beneficial as measures for preventing falls in the community-dwelling older people. In the future, longitudinal analyses to elucidate causal relationships and community-intervention studies should be pursued.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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地域在住高齢者におけるうつの程度別による趣味活動の特徴—うつ予防・支援の手がかりとして—

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要旨

本研究の目的は，地域在住高齢者におけるうつの程度別による趣味の種類を明らかにし，趣味によるうつ予防・支援の手がかりを得ることである．対象は地域在住高齢者71,097人で，趣味ありが42,129 人，趣味なしが28,968 人，趣味ありのうちGDS-15では，うつ症状なしが33 659人，うつ傾向とうつ状態は8,470 人であった．全対象の趣味の種類では，散歩／ジョギングや園芸が多く，趣味によるうつ予防・支援ではこれらを用いることが受け入れられやすいと考えられた．うつの程度別では男性女性ともに，うつ症状なしはスポーツ的，観光的，文化的な趣味が多い一方，うつ傾向とつ状態ではパチンコや将棋／囲碁／麻雀が多いという特徴が示された ．

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Association between the longest job and oral health: Japan Gerontological Evaluation Study project cross-sectional study

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Abstract

Background: Inequality in oral health is a major challenge. Oral diseases and their risk factors accumulate throughout life. The objective of this cross-sectional study was to examine the association of longest job with oral health status and oral health behavior among older Japanese.

Methods: Subjects were a total of 23,191 (11,310 males and 11,881 females) community-dwelling individuals aged 65 or over, living independently and able to perform daily activities from 30 municipalities across Japan. The outcome variables were oral health status (number of teeth, use of denture or bridge and subjective oral health status) and oral health behavior (dental visit for treatment and use of interdental brush or dental floss). The longest job was used as an explanatory variable. Age, educational attainment, equivalent income, and densities of dentists and population in municipalities were used as covariates. Two-level (first level: individual, second level: municipality) multilevel Poisson regression analyses were performed for each sex.

Results: Multilevel Poisson regression analyses showed that all variables of oral health status and oral health behavior were significantly associated with longest job after adjusting for all covariates except denture/bridge use and dental visit for females. People whose longest jobs were sales/service, skilled/labor, agriculture/forestry/fishery or others, or who had no occupation were more likely to have poor oral health status and oral health behavior compared to those whose longest jobs were professional/technical.

Conclusions: The longest job may be one of the major determinants of oral health status and oral health behavior in Japanese older people.

Keywords: Longest job, Oral health status, Oral health behavior, Older people, Cross-sectional study

Background

As oral diseases and their risk factors accumulate throughout the course of life, meaning that inequality in oral health is a major challenge in an aging society [1]. Studies have shown socioeconomic inequalities in oral health status [2,3] and oral health behavior [4] in older people.

Occupation has been used in epidemiological studies as a marker of socioeconomic status [5]. Occupational environment is important for health because people spend long hours at work during their lifetime. Therefore, the oral health of older people is affected by work time stress and health care policy in their occupational environment.

In Japan, some municipalities have oral health programs including periodontal examination for adult residents; however, participation rates (3.6% in 2002) are often not satisfactory [6]. Workplaces are suitable for oral health education and screening of periodontal disease because most of the target population would be involved. However, few workplaces have such systems [7].

Occupational classification is one marker of socioeconomic position and is associated with the health status of older people including the risk of chronic obstructive pulmonary disease [8], subclinical atherosclerosis [9] and chronic disabling pain [10]. Studies using employees in companies suggest gradients of oral health

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