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Supplement

Interviewing insights regarding the fatalities inflicted by the 2011 Tohoku-oki earthquake

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17 **Text A. On the three death rates**

18 This study uses the number of deaths as the sum of deaths and missing persons. Three
19 death rates were discussed in this study:

- 20 1) The mean death rate: the number of deaths divided by the population in each city.
- 21 2) The inundation death rate: the number of deaths divided by the inundation population
22 that is available from the Statistics Bureau and the Director General for Policy Planning
23 of Japan (DGPPJ) {4}.
- 24 3) The high-inundation death rate: the number of deaths divided by the population
25 estimated from the number of completely collapsed houses.

26 The first death rate is the ratio with respect to the entire city, including the highlands,
27 and is thus lower than the other death rates. The second inundation death rate is based
28 on the population of the total inundation area for each city provided by the Statistical
29 Bureau. The average death rate in the inundation area is 3.3 % in the Iwate and Miyagi
30 prefectures. Nevertheless, there are several cities in which the inundation populace is
31 disproportionally large compared with the numbers of collapsed houses. This estimation
32 was based on surveys using air photos to count the approximate number of houses in the
33 inundation area regardless of the tsunami heights. The population is not necessarily
34 suitable to understand how local residents evacuated from the fatally inundated tsunami.

35 The third death rate is ratio for the area where the tsunami height reached higher than
36 2-20 m and where most houses were damaged by the tsunami. People in the area needed
37 to evacuate to survive before the tsunami struck. As stated earlier, deaths were mostly
38 caused by drowning. The National Police Agency (NPA) used the term of collapsed to
39 describe a house that was completely or partially drowned and destroyed by the tsunami.
40 Some houses with completely destroyed and inhabitable interiors due to water damage,
41 even if they are still standing, were also counted as “completely collapsed”. The NPA
42 released reports that 92% of the mortalities were from drowning, 5% from fires and 1 %
43 from injuries. Because the fatalities from fires were also caused by tsunami damage,
44 95 % of the fatalities were from the tsunami damage. Using this observation, we
45 estimated the population in the tsunami fatally inundated (high-inundation) areas.
46 Multiplying the number of these houses by the average family number per household,
47 we obtained the population estimates for the high-inundation areas. Thus, the tsunami
48 high-inundation death rate can be obtained based on the number of houses. In the

49 interviewed areas, most people stayed, worked or studied in the same city or
50 neighboring coastal cities because the inland populated areas are 2-3 h away and
51 involve driving across the mountain ranges. Accordingly, this method can provide an
52 approximate estimate of the population in fatally inundated areas. The average death
53 rate of the high inundation is 5.2 % in Iwate and Miyagi prefecture

Table A. Three death rates for the coastal cities for Iwate and Miyagi prefectures

1	2	3	4	5	6	7	8	9	10	11	12
City	Latitude, deg	Death rate in city, %	Death rate in inundation areas, %	Death rate in inundation areas, %	No. of deaths	Population	Population in inundation areas	Population estimated from collapsed houses	No. of households	No. of family members per household	No. totally collapsed houses
Tanohata	39.93	0.8	1.8	4.4	29	3,843	1,582	661	1,309	2.9	225
Iwaizumi	39.88	0.1	0.6	1.6	7	10,804	1,137	439	4,355	2.5	177
Miyako	39.641	1.7	5.6	10.6	1,024	59,442	18,378	9,691	22,504	2.6	3,669
Yamada	39.468	4.1	6.7	9.8	760	18,625	11,418	7,788	6,605	2.8	2,762
Otsuchi	39.360	8.5	11.0	15.7	1,306	15,277	11,915	8,325	5,674	2.7	3,092
Kamaishi	39.276	2.6	8.0	14.4	1,047	39,578	13,164	7,266	16,095	2.5	2,955
Ofunato	39.082	1.0	2.2	4.0	425	40,738	19,073	10,530	14,814	2.7	3,829
RikuzenTakada	39.015	7.9	11.1	21.4	1,846	23,302	16,640	8,609	8,550	2.7	3,159
Kesenuma	38.909	1.9	3.4	5.6	1,368	73,494	40,331	24,504	25,464	2.9	8,490
Minamisanriku	38.667	5.0	6.1	8.5	875	17,431	14,389	10,343	5,295	3.3	3,142

Onagawa	38.446	9.2	11.5	12.5	922	10,051	8,048	7,404	3,968	2.5	2,923
Ishinomaki	38.428	2.3	3.3	6.0	3,739	160,704	112,276	62,147	57,812	2.8	22,357
Higashimatsushima	38.426	2.6	3.3	6.6	1,113	42,908	34,014	16,771	13,995	3.1	5,470
Matsushima	38.381	0.0	0.0	0.3	2	15,089	4,053	642	5,149	2.9	219
Rifu	38.330	0.1	8.5	26.6	46	34,000	542	173	10,819	3.1	55
Shiogama	38.315	0.1	0.2	1.5	32	56,490	18,718	2,105	20,314	2.8	757
Shichigahama	38.304	0.4	0.8	3.5	75	20,419	9,149	2,139	6,415	3.2	672
Tagajyo	38.294	0.3	1.1	4.3	189	62,979	17,144	4,418	24,047	2.6	1,687
Sendai	38.269	0.1	2.4	1.1	730	1,045,903	29,962	64,776	464,857	2.2	28,790
Natori	38.172	1.3	7.9	11.8	966	73,140	12,155	8,157	25,150	2.9	2,805
Iwanuma	38.104	0.4	2.3	9.3	183	44,198	8,051	1,958	15,530	2.8	688
Watari	38.038	0.8	1.9	3.7	269	34,846	14,080	7,347	10,899	3.2	2,298
Yamamoto	37.961	4.1	7.7	9.8	690	16,711	8,990	7,073	5,233	3.2	2,215

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57 Columns 2, 3 and 4: see Appendix A; 5, 6 and 11 are provided by the Fire and Disaster Management Agency (FDMA,

58 <http://www.fdma.go.jp/bn/higaihou/pdf/jishin/144.pdf>, as of 14 Feb 2012); 7 and 9 are provided by the DGPPJ,

59 <http://www.stat.go.jp/info/shinsai/index.htm#kekka>, March 29, 2012); 10: obtained from dividing the value in column 4 by that in column 8

Table B. Age-specific fatality and population in three prefectures (Iwate, Miyagi and Fukushima)

Age range, years	1. Number of deaths		2. Death rate, %		3. Population rate, %		4. Death ratio with respect to 0-9 age range	
	Female	Male	Female	Male	Female	Male	Female	Male
0-9	200	191	1.8	1.7	4.2	4.4	1.0	1.0
10-19	171	165	1.5	1.5	4.8	5.1	0.7	0.7
20-29	179	220	1.6	2.0	5.5	5.4	0.7	0.9
30-39	303	331	2.7	3.0	6.9	6.9	0.9	1.1
40-49	401	386	3.6	3.5	6.4	6.3	1.3	1.4
50-59	661	659	6.0	5.9	6.9	6.7	2.0	2.3
60-69	995	1129	9.0	10.2	7.0	6.6	3.0	3.9
70-79	1318	1345	11.9	12.1	5.8	4.5	4.8	6.9
80-	1516	938	13.6	8.4	4.4	2.2	7.2	9.8
Unknown	1292	607	-	-	-	-	-	-

Column 1: Data from the National Police Agency; 2. Ratio for each age range and gender to the total deaths with known ages; 3: Rate for each age range to the total population in Iwate, Miyagi and Fukushima prefectures; 4: Death ratio for each age range normalized by the death rate of the 0-9 year age range

Fig. A

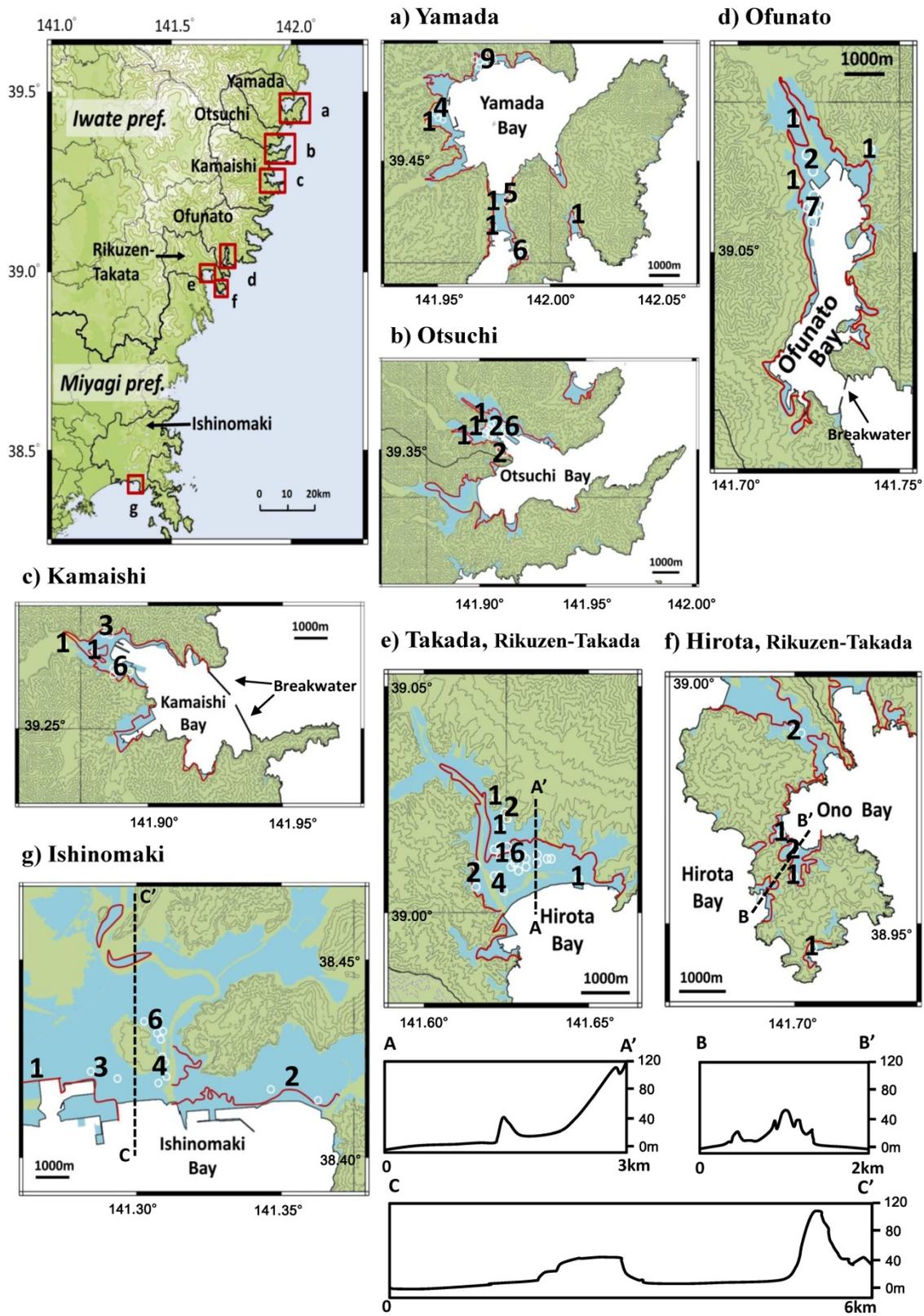


Fig. A. The number of interviewees who felt the 2011 Tohoku-oki earthquake in the six cities in which interviews were conducted. The same maps but with tsunami heights are shown in Fig. 2. (a) - (g) the map of the interviewed area of each city shown with topographic contour lines at 50 m intervals. The inundation areas of the 2011 Tohoku-oki tsunami (light blue) are provided by the Association of Japanese Geographers ({6}, No. 6 in Table 2). The red lines show the tsunami inundation limits that were forecasted in 2006 by the Iwate and Miyagi prefecture offices, based on the scenario earthquakes A, B and C in Fig. 7 (Iwate and Miyagi prefecture offices {12}, No. 12 in Table 1). The forecast inundation limits at each site were taken as the highest values among the three models. Numerals are inundation or runup heights of the observed 2011 tsunami in meter (Tohoku Earthquake Tsunami Joint Survey Group {5}, No. 5 in Table 1). Subdivision maps Takada and Hirota of Rikuzen-Takada city are depicted separately. Profiles of A-A', B-B' and C-C' are also shown at right-bottom of the figure.